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A Public Works Doctrine

••• Realization that economic recovery can be brought about only through a huge expansion of public construction is at last becoming more general. The Construction League of the United States has just declared in a resolution that large-scale employment on construction not competitive with private industry is necessary. And a clearheaded banker, Paul Mazur, said last week that he favored any program of public works expansion that would make jobs.

••• Such doctrine ought to be made known the country over, in every civic gathering, before business men, industrialists and taxpayers. The man in the street has become a vociferous advocate of government curtailment. New improvements particularly are singled out for abandonment. Does he foresee the certain effect of such action?

••• A trade-recovery committee has just been organized to provide leadership in a campaign of re-education. Engineers by virtue of their knowledge and training are in the first line of battle in this campaign—to create in every citizen and taxpayer the will to rebuild employment and business through community construction of public works.

....From an editorial in this issue

McGraw-Hill
Publishing
Company, Inc.

May 12, 1932

Across the Brandywine on **BRICK**

Washington Street Bridge, Wilmington, Newcastle County, Delaware — completed 1932

AT the historic spot where Washington forded Brandywine Creek, there is a magnificent bridge . . . built as a memorial to the World War Dead. In the city of Wilmington, Delaware, it forms an essential link in the most important traffic thoroughfare. ◪ A modern brick-surfaced pavement with mastic cushion and modern asphalt filler, was laid on this bridge, over an old concrete base. To complement the architectural beauty of this structure, the traffic lanes, on either side of the tracks, were paved in a herringbone design. Special pains were taken also to preserve the natural color and beauty of the material itself . . . by applying the filler after the pavement had first been painted with white-wash, and then removing all excess filler from the surface. ◪ Modern Vitrified Brick was selected for this project because the Commissioners wanted the *strongest* material in order to meet the heavy traffic conditions normally prevailing here. Not only strength, however; but smoothness, beauty and economy to taxpayers also contribute the success of this fine brick-surfaced pavement across the Brandywine.

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F. E. Schmitt, Editor

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Public Construction for Business Recovery

"PUBLIC works can employ the idle and can make available to them, not by gift but by right of labor, the stores of food, clothing and shelter of which the country has abundance. Private business has proved powerless to maintain the workers at their jobs. A national emergency lies ahead, but if the will to provide it is strong enough work can be found for all."

The quotation is from our editorial page of Sept. 3, 1931. In the eight months since it was written the situation has become daily more serious, and, with the approach of the summer season, of unexampled gravity. The barometers of business have gone down steadily, and today they point to "Changeable" or even "Stormy" despite the sunshine of spring.

FORTUNATELY a realization that recovery can be brought about only through work is at last becoming more general. Sedatives in the form of budget balancing and bank credit rehabilitation no longer bear hope of providing the increased purchasing power needed to stimulate industry. Work is the only remedy, and only work on public construction is available.

People of different tempers of mind are recognizing the hopelessness of continuing to rely on philanthropic relief until business can put the idle workers back on its payrolls. They have heard charity admit its failure; it is calling for a federal dole. They see that if we would pull ourselves out of the mire of deflation, unemployment and bankruptcy we must turn resolutely to hard work, work so distributed as to restore wage-earning throughout the country. They have been learning that private industry and trade, with no orders on t ir books, are unable to provide opportunity for such w k until new purchasing power brings the orders that will make jobs. And despite all the outcry against taxes and government burdens, they are finding that the only business which has unlimited orders on its books is public construction.

THOSE who are closest to the physical facts understand the situation most clearly. The Construction League of the United States, which embraces a wide range of business interests, has just declared in a resolution, "In order that the need for public doles may be minimized, large-scale employment on construction work not competitive with private industry is necessary." The American Society of Civil Engineers, broadly representative of technical activity, is considering similar action. Labor, hardest hit by the country's impoverishment, declares through William Green, its head, that a great public-works program must be put under way immediately by the federal government to restore prosperity and give the nation a chance. "The people are living without enough on which to subsist," he says truthfully. And the American Water Works Association, gravely concerned over "the critical condition of waterworks throughout the country and the large increase in unemployment due to vanishing construction work," denounces the wholesale measures being taken to reduce community services and the refusal to finance waterworks construction, and demands means for assuring adequate credit.

Men of trade and industry also have begun to appreciate the disastrous results of the economy complex which, originating with investment and real-estate interests, has fastened on the public at large and has cut two billions of dollars in construction and service out of the year's municipal budgets. A number of business leaders have been active during recent weeks in attempts to turn public and private thinking toward the imperative necessity of building up employment through public works.

And within a fortnight a clearheaded banker pictured the present situation in strikingly simple form. Addressing the American Institute of Architects, Paul Mazur, of New York, said that there are three things to do: Allow living standards to be forced down farther and industry to shrink correspondingly, wait for the magic of administration remedies to bring back prosperity, or create new business. He was all for the latter, and he favored any program of public-works expansion to make jobs, purchasing power and business vitality.

IT IS SUCH doctrine that ought to be made known the country over, in every civic gathering, before business men, industrialists and taxpayers. Under the persistent deflationary efforts of the economy and liquidation school, powerfully aided by extreme credit and money shortage, the man in the street has become a vociferous advocate of government curtailment, of stoppage of all possible expenditure, especially on new improvements. Now it is necessary to reawaken him to the fact that every curtailment of construction has put more men out of work and has further endangered his own ability to carry on. Engrossed with his tax bill, he has failed to see not only that he is no longer employed by private business but that he is rejecting in public construction the only substitute employer in sight.

A business recovery committee has just been organized to provide leadership in the campaign of reeducation, drawing upon all classes of men for assistance. Engineers by virtue of their knowledge and training are in the first line of battle in this campaign, and their vigor

and skill can be largely influential in determining how rapidly business health can be restored.

BUSINESS reconstruction through public construction is the theme of the day's new thinking. It exhibits a reborn faith in the nation's ability to stop the cumulative process of disintegration of business activity and living standards by utilizing in planned and intelligently directed manner the most powerful forces at our command. So soon as this faith is expressed in concrete action it will build confidence in the future on a firm base of confidence in the present. By paying men to produce instead of paying them to be idle it will put an end to the waste of tens of billions per year in unutilized productive power.

Federal aid in financing local public works will be needed, even though the municipal bond market is growing stronger under the pressure to buy tax-exempt securities as a defense against heavy tax legislation. The bond paralysis of the past six months, which grew when the investment banking fraternity abdicated its function, is a significant warning to press for early and effective action by Congress in providing the credit machinery for assuring the continuance and expansion of public improvements. This is one part of the task. The other, and perhaps the greater, is to create anew in every citizen and taxpayer throughout all states, cities and towns the will to rebuild employment, business and the wellbeing of the commonwealth through public construction.

NOTES OF THE WEEK

Builder of Subways

NEARLY forty years ago the first New York subway was planned. With such genius was that pioneer undertaking directed that it still stands as the precedent and pattern of rapid-transit subways; hundreds of millions of dollars have been invested in construction modeled closely after that first project. The genius was that of William Barclay Parsons, whose brilliant engineering perception and farsighted vision created the model and carried it through to success, the world's most famous rapid-transit railway. What he wrought then, at the height of youthful vigor, lives as his great monument. His later years of professional activity were filled with work of value and note—work not alone in civil engineering and in manifold public duties but in his inspiring leadership of the first railway regiment to enter the World War for his country. In his passing he is remembered for all these achievements and mourned as an ideal engineer and man of culture. Yet his name is most deeply impressed on the record of service to modern civilization as the great subway builder.

For Efficient Service

AFTER years of effort the campaign for a federal public-works department reaches action, but at a time unfavorable to thorough consideration of the problems involved. Congress is preoccupied with the overshadowing problem of restoring confidence, financial health and business life; under these circumstances it cannot be expected to give deep thought to the secondary problem of rearranging a group of governmental activities, more especially since there have been no really serious shortcomings in the government's construction work. But since the issue is actively before Congress it claims careful attention on the part of those most directly affected. A prime consideration, as R. C. Marshall points out in this issue, is assurance that the directing head of the new department will be competent and independent. Any uncertainty here would be fatal to the success of the proposed centralized construction system. Unless the bill can be made sound in this and other respects it would be far better killed than passed. Centralization is not the only road to efficiency, nor always the best. It should be well done or not done at all.

Late in the Day

RAPID improvement in municipal bonds has carried the highest grades of these securities almost to normal levels. Whether the change is due to a rush to buy tax-exempt paper and therefore is temporary or whether it has more lasting character remains open to doubt, but on the most favorable assumption it comes late in the day, probably too late to be of great effect on the current year's construction. The shortage in financing accumulated during the first four months may grow, as bond issues are accelerating but slightly. The corresponding shortage in construction means thousands of men put out of work, adding a dangerous load to the present unemployment burden. In view of these conditions the course of financing in the next few months has intense interest. If it should turn upward sharply, part of the lost ground may yet be recovered.

A Foredoomed Failure

THE report in this issue on the Illinois test of brick surfacing on a sheet-metal base confirms the evidence of experience that an enduring brick pavement requires a rigid base. Wherever in actual construction brick have been laid on a non-rigid base material they have failed to maintain surface and commonly have not preserved their integrity as a surfacing. In the Illinois test they failed in both respects—the original true surface was lost first and then the bricks were displaced from the surfacing. The cause was base flexibility and not inadequacy of the flexible structure. The steel diaphragm, closely fitted to the subgrade, was about as perfect a flexible-base structure as modern construction materials make possible, but its very flexibility led to its failure. Until this property was brought into action by the softening of the subgrade by moisture—that is, as long as the diaphragm was kept rigid by the subgrade—there was little damage

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to the surface or to the surfacing. With flexure, destruction of the joint bond began and traffic and water progressively tore apart the surface and deformed the steel base. Neither steel nor brick failed as a material, but their structural combination was wrong.

For Lack of Fire-Stops

THE fire which wrecked one of New York's great Chelsea piers last week served to emphasize again the need for adequate means of preventing the *spread* of under-wharf fires. The Chelsea piers, built during the early part of the century, have superstructures built largely of steel and supported on a timber deck carried on wooden piles. Over the supporting timber deck is a concrete floor surfaced with asphalt. Beginning as a small fire in the timber decking below the boiler room, so small that an alarm was not sent when the fire was discovered, the flames spread despite the efforts of all the firefighting apparatus that could be assembled both on land and water until, 24 hours after the fire began, the entire pier and much of the headhouse was a tangled ruin. Protected against attack from above by the concrete deck, the fire spread along under the pier to the headhouse and for a time threatened to spread to adjoining piers. Collapse of the substructure wrecked such parts of the superstructure as were not reached by the fire. New York's piers have been singularly free from disastrous fires, doubtless a reason why the great risk of such a fire as this one of last week has not been recognized. It should not go unrecognized longer, in New York as well as in other ports where timber substructures are used for piers and wharves. Possibly this fire, coming just a week before the National Fire Protection Association meeting in Atlantic City, may serve forcefully to impress the need for such protection upon men in a position to translate thought into action. Fire-stops should be added to existing piers and wharves as well as built into new ones.

Sober Second Thought

THE action of the Associated General Contractors in attacking the surety bond companies on the floor of the open meeting of the executive board held last week in Washington should receive the sober second thought of its membership. A charge of bad faith, brooked by the vicious political set-up of a local bonding situation, seriously endangered the only reform activity that in years has accomplished any good in the underwriting of surety bonds: the valuable initiative and support of contractors and bond underwriters of a factual record of those carrying on contracting businesses. In the eyes of public-works officials and professional engineers and architects this has been the outstanding accomplishment of nationally organized contracting.

Following half a decade of mutual distrust and bitter wrangling by associated contractors and associated surety companies, a few temperate members on both sides converted a disagreement into cooperative effort which initiated the Bureau of Contract Information. The work of this bureau in assembling verified performance records of 6,000 contractors proved to be a strong force in reducing irresponsible competition in contracting. The surety companies' share of cooperation in this activity has been to shoulder the cost of nearly $200,000 and to distribute the information free to every agency awarding contracts. It should entitle them to reasonable credit for good faith.

Admitting that all expenditures may have been returned by the direct value of the bureau to the surety companies, their contribution of money and service has advanced the stabilization of construction. This is a service which construction in its disorganized state cannot lightly disregard; contracting, as an important element of construction, should be first to encourage that thought. It is to be hoped that consideration will bring it to this conviction and that the cooperation of contractors and those who will write their surety bonds may continue as it has so well begun.

Diversion of Road Taxes

THE able fight against the diversion of road tax money in New York should continue despite the failure of its immediate purpose to call the state legislature into extra session. The principle involved is more important than the need of 1932 roadbuilding, great though this need may be. The legal theft by the New York legislature of half of the tax money exacted from motor car owners for roadbuilding is the largest ever ventured. If the breach of faith with the taxpayer, pointed out by a correspondent in this issue, is allowed to go uncontested the diversion which now masquerades as an emergency measure will become a permanent policy and the tax bill become subject to further depredations by hungry public agencies. Success of the New York diversion will carry encouragement to gas-tax raiders elsewhere.

Obviously the present situation demands a changed front. Until now the fight in New York has been in part to preserve roadbuilding in 1932. From this time on it must be directed against road-tax diversion. In this battle the roadbuilding industries will have the support of powerful interests not directly chargeable with the desire to obtain roadbuilding contracts and to sell roadbuilding materials. The oil companies, the granges, which are demanding farm roads, and the automotive interests are logical allies of the roadbuilding industries in the fight against road-tax diversion; they can be swung into the battle line with weighty effect. The occasion is too desperate to be met by half-way measures.

Road-tax diversion by the last New York state legislature is indicative of a desperate attempt by legislatures of all kinds from the federal congress down to township supervisors to evade real taxation issues. Public agencies with depleted treasuries are bombarding the legislatures for money, and the lawmakers are taking it where they find it. The motor-vehicle tax for roadbuilding is the present most obvious source of ready money and is therefore being robbed. Its protection calls for defense as desperate as are the attacks being launched against it. Issues of tax incidence, tax rates and tax distribution, which normally concern road departments and road users, are of minor importance compared with defense of the tax itself against diversion from highway improvement. If diversion can be prevented, rates can be kept down to moderate imposts on the motor vehicle user and roadbuilding can go ahead with all reasonable speed. This is the task to which the roadbuilding industries must bend their energies.

Centralized Public Works For Efficiency

A current reform that has been under study for many years will promote the efficiency of government construction work—Some essential safeguards that should be included in the bill are not yet provided for

By R. C. Marshall, Jr.
Vice-President, B-W Construction Co., New York

AT LAST a federal public-works department is in sight, provision for it being included in the economy bill with which Congress is now wrestling. The new department is called "an Administration," to avoid official jealousies, but regardless of name it centralizes effectively a wide range of operations now scattered among more than a hundred separate bureaus. General Marshall has been in contact with the public-works reorganization movement for a score of years, and so speaks with knowledge. He calls for engineering support in securing the inclusion of certain needed amendments.
—EDITOR

SHOULD ENGINEERS individually and collectively take part in legislation? Are they competent to advise our legislators with respect to organization for public works, the doing of which is almost exclusively in their hands? Should they refrain from taking active interest in the form that legislation shall take, setting up the government organization for the doing of public works—particularly at a time when such a question is a trenchant one before Congress? The answer to these questions seems obvious.

Legislation is now before Congress looking to the consolidation of the federal agencies which do public works. This legislation has passed the House and it seems probable that it will come to a vote in the Senate before adjournment. This could not have been said about such legislation within the lifetime of any man reading the present lines, so that if ever there has been an opportune time for the engineer to express himself on this, it is in the month of May, in the year of our Lord 1932.

From war experiences to now

Essentially the present reform legislation is the outgrowth of the turmoil of war-time construction activities. It is true that public-works centralization was discussed as much as twenty years ago, but the days of 1917 and 1918 gave it vitality.

At a meeting in Chicago in 1919, attended by representatives of 52 national organizations and 85 state organizations from 31 states, with an underlying membership of about 135,000 industrial men, engineers, architects and constructors, there was formed the National Public Works Department Association, whose sole activity for some years was trying to obtain federal legislation for a national department of public works. In the words of its chairman, its aim may be summed up under the caption "Economy and efficiency in the conduct of government business through the national organization of public work activities, the diminution of overhead charges, the elimination of needless and costly duplications, and the utilization of the common principles and precepts on which wise business conduct is based."

The amount of construction work done annually by the federal government from 1921 to 1931 averaged about $200,000,000; that contemplated for the fiscal year 1932 is about $515,000,000, with an estimated average of some $400,000,000 for the next five years. No one can seriously contemplate such a volume of construction by the government without registering in his mind the thought that past work could have been administered and done more economically.

A hundred separate bureaus!

From the taxpayers' point of view this work should be done as economically and efficiently as modern methods will permit. From an engineering point of view not only should the same thing apply but, through the conduct of this work, the federal government should have a profound influence on the construction industry and on the conduct of public works in states and cities. Because of the segregated entities under which this work is now done in the federal government, no such influence exists.

There are some 100 agencies of the government that do this construction work, each independently. Some do a small amount. About 30 such agencies do work of some magnitude. Each has its technical organization. Each has its contracting and operating force. Each designs its own highways, waterworks, sewage-disposal plants, buildings, dams or what not and generally speaking without reference to the information or knowledge others have gained. There are some exceptions to this statement but not many.

It soon became evident that a separate Department of Public Works was not acceptable to Congress, and that the public-works function if consolidated would be either a subdivision of one of the existing executive departments or, as has developed in the last eighteen months, there might be established the so-called Administration of Public Works. This latter idea was brought into our federal structure through the formation of the Veterans' Administration, whose potentialities for efficiency and substantial savings are great.

Consolidate with caution

Consolidating does not necessarily mean efficiency and efficiency does not necessarily mean economy. The limited space of this article does not permit a discussion of the mistakes that have been made in industry through centralization and the subsequent reversion to decentralization. We have such experience squarely before us, and in any centralization of authority it should be used. We should not go blindly to centralization because it consolidates. Just as much care should be exercised in those government agencies which should not be consolidated as in those which are to be consolidated. Therefore, wisely, provision should be made for the exception of those agencies of the government which Congress feels should be left *in statu quo*.

Self-preservation is said to be the first law of nature, and no act of Congress or of any other legislative body can change it. The general theory of efficiency and economy resulting from consolidation of public-works functions can hardly be refuted by anyone; the advantages seem obvious.

It is believed that the principal resistance to the establishment of an Administration of Public Works comes from the activity in Washington of federal employees in the several bureaus whose status, if not their jobs, is always in jeopardy when such a consolidation is brought about. In a memorandum prepared by the writer under date of March 26, 1924, for the joint committee on reorganization of the administrative branches of the government, there is said in part:

> The proof of the soundness of such a procedure lies in the practical unanimity with which such practice is followed by great organizers in all lines of endeavor. The opposition to it rests in the main upon the desire of strongly entrenched bureaus to preserve intact their advantageous position. The fundamental considerations have been much obscured by the interjection of argument related to human failure or success not pertinent to the general conclusion.

The bill now before Congress contains a provision for an Administrator of Public Works. It does not state his qualifications, however, nor his tenure

of office, nor does it give him retirement privileges. It is believed that the law should cover these points. In most discussions on this subject it has appeared to be the undivided judgment of those considering it that for the administrator to be a success he must not be a football of politics.

As to the Administrator

He must be given a sufficient tenure of office to set up the new administration, to establish policies and to make them effective. The bill does not place the administrator within the civil service law. This is probably wise, but certainly the administrator should not come and go with political administrations, nor be subjected to the influence incident thereto. It would seem that his tenure of office should be no less than ten years and probably as long as fifteen years, subject to removal for cause.

The engineers of the country have continuously, since 1919, been discussing what provisions in their judgment are wise to include in the law setting up the Administration of Public Works. There are some provisions on which there is a division of judgment. There are others on which it seems all are united, among them the following:

A—The law should make specific provision for the qualification and tenure of office of administrator.

B—It should provide for technical services to be done by private concerns, keeping to a minimum the number of employees in the government service.

The majority of engineers believe that all public works should be brought into the Administration of Public Works unless the fact that this cannot be done is so evident as not to admit of discussion. Some engineers believe that there are questions of public policy which make exceptions advisable. This latter is evidently concurred in by the House, as the economy act makes provision for the exception of the works of the Engineer Corps of the Army and of the Bureau of Yards and Docks of the Navy. If these two are to be exempted, they should be exempted under the same provisions.

Relations to Army and Navy

I believe that there is a unanimity of opinion that the Administration of Public Works should be used to the practical limit in being available to the offices of the Army and Navy, to increase their efficiency as such. It is believed that there is an equal unanimity of opinion that the reverse of this should not be true. Hence, it is believed that when the economy bill is before the Senate for consideration the exemption clauses (if there are to be any) now contained with reference to the offices of the Corps of Engineers of the Army should be merged with that for the office of the Bureau of Yards and Docks of the Navy. To be more explicit, to eliminate those now in the economy act, to wit: (*b*) and (*c*) of Sec. 502 of H.R. 11267, and substitute therefor the following, applicable to both alike:

> The Corps of Engineers of the United States Army and the Bureau of Yards and Docks of the Navy Department shall remain as now provided by existing law and no provision of this title shall be construed to authorize any transfer, consolidation, coordination, or change in the duties and responsibilities of the said corps or bureau and the chiefs of the corps or bureau or the officers therein. The Secretary of War or the Secretary of the Navy, upon the request of the Administrator of Public Works, may detail officers of such corps or bureau for other duties in public works, constructions, and activities; and the Administrator of Public Works shall utilize the services of such officers whenever practicable; and when so detailed with the consent of the Secretary of War or the Secretary of the Navy, the said officers shall be under the supervision and direction of the Administrator of Public Works.

This suggestion, which conforms entirely with the spirit of what is in the national economy bill, places the two services on the same plane and does not admit of what might prove to be a difficult interpretation of the law as between the two services.

Competence is vital

With reference of the qualifications of the Administrator of Public Works, it is believed that there should be substituted for the language now in the economy bill the following:

> The Administrator of Public Works shall be appointed by the President, by and with the advice and consent of the Senate, and shall by training and experience be qualified to administer the affairs of the Administration of Public Works and to evaluate the technical principles and operations involved in the work thereof; and shall hold office for ten years. He shall be removed from office only for cause, by the President, who shall communicate in writing to the Senate and House of Representatives in Congress assembled the fact of the removal of any Administrator of Public Works together with the reason for the removal. The Administrator of Public Works shall receive a salary of $12,000 per annum. The Administrator of Public Works shall be subject to the provisions of the retirement act of May 22, 1920, as amended, and the regulations thereunder and shall be retired in accordance with provisions of said act.

With reference to the activities of the Administration of Public Works, if it should start out with a firm practice of, wherever practicable, letting to private firms the technical work in connection with architecture and engineering, it is the belief of engineers that both the government and practicing engineers will be benefited. The argument on this subject cannot properly be recited here, but to accomplish it we believe that there should be inserted in the national economy act the following:

> The Administrator of Public Works is hereby authorized to employ by contract and at the established rates of compensation outside professional or technical service of competent persons, firms or corporations, for the architectural and engineering designing and planning of such federal projects as are now or may, in the future, be placed under his jurisdiction without reference to the classification act of 1923, as amended, or to section 3709 of the Revised Statutes of the United States.
>
> Such employment shall be based at all times on the highest grounds of proven professional ability. Architects or engineers shall not be employed without prior submission to the Administrator of Public Works of satisfactory evidence of their qualifications and experience.
>
> Whenever circumstances warrant, such services shall be contracted for by the employment of the ablest architects and engineers resident in the general sections of the country wherein such federal projects are to be erected. All such individuals, firms, or corporations shall render their services subject to the approval and under the direction of the Administrator of Public Works. The cost of compensation for outside professional or technical services shall be charged to the appropriation for the construction of the project for which such services are rendered.

In conclusion, with respect to the question of establishing an Administration of Public Works, and the question of those essential provisions in the act therefor which engineers have thoroughly discussed and in which they believe, now is the time to act. It is, therefore, again urged that everyone who reads this article write to his Senator and to his Representative—or better still, see them—and urge that the foregoing changes be included when the bill is considered in the Senate. In writing, the proper reference to make is "Title 5 of the National Economy Act," which is the section dealing with the Public Works Administration.

SUGGESTED IMPROVEMENTS

The law should make provision for a competent administrator and should protect him in his tenure of office from the influence of change in political administration.

It should place the Engineer Corps and the Bureau of Yards and Docks on a par in their relation to the Administration of Public Works.

Provision for engagement of private architectural and engineering firms wherever practicable is held to assure important benefits to the public service.

Now is the time to work for inclusion of these provisions in the law.

Constructing the Santiago Creek Rolled-Earth Dam

Placing of 1,103,700 cu.yd. of fill is accomplished in four months by concentration of motor equipment—Use of belt conveyor for transporting material presents difficulties—Reservoir provides 26,000 acre-ft. of storage for joint irrigation use in southern California

By C. R. Browning

Chief Engineer, The Irvine Co., Tustin, Calif.

THE LARGE YARDAGE of material to be handled in building up an earthfill dam always requires those who lay out the construction program to seek the most economical method of taking earth from the face of a borrowpit and spreading it out over a wide area at a point a considerable distance away. Shape and height of the dam, as well as the shape, location and relation of the borrowpits to the dam, are variables that make it impossible to apply any general rule or to insure the successful application of a particular type of equipment to one job just because that type of equipment proved successful at another job. This, in part, explains why the use of belt conveyors for delivering filling material to the Santiago Creek dam in California did not prove to be successful when similar equipment proved eminently successful in such structures as the Wanaque dam in New Jersey. Explanation of failure is found not in the equipment used but in attempting to apply it to a task for which it is not suited.
—EDITOR.

CONCENTRATION of excavating and motor equipment permitted the construction of the Santiago Creek rolled-earth dam in Orange County, Calif., at an average placement rate of 10,000 cu.yd. of fill per day. The structure, 130 ft. high above streambed and 1,400 ft. long at the crest, was built as a joint storage project for irrigation of The Irvine Co.'s property, the Serrano Irrigation District and the Carpenter Irrigation District. The reservoir will store 26,000 acre-ft., and the division of water and project cost will be allocated at 50 per cent to the company and 25 per cent to each of the districts. In addition to the speed of construction, an interesting feature was the introduction of a belt-conveyor system for moving material from pit to fill.

In design the structure is a typical rolled-earth-fill type of dam with downstream slope of 2:1, upstream slope of 2½:1, two upstream cutoff trenches extending into bedrock, and a reinforced-concrete facing. The cross-section is shown in Fig. 1, which indicates the relative proportion of impervious material in the upstream section and pervious material used for the remainder of the fill. The facing slab is 6 in. thick reinforced by ½-in. square bars on 12-in. centers in both directions. The slab was laid in 10-ft. staggered squares with reinforcing broken at the joints.

Hydrology—The runoff area above the dam site is 63 square miles and reaches an elevation of 5,680 ft. Streamflow conditions are typical of southern California, with a dry channel during summer months and the possibility of torrential floods during heavy winter rains. In normal years of flow the streamflow ceases about July 1 and begins again about January or with the first heavy rain.

From 1927 to the present rainy season no surface flow has reached the site because of deficiencies in annual precipitation. During these years the flow, even during the winter months, spread out into the gravel bed of the canyon, and much of it was recovered in the succeeding irrigation season by a submerged dam 3 miles below the new dam. The agreement reached by the interests involved in the development provides for carry-over storage operated on a three-year basis, one-half to the districts and one-half to the company.

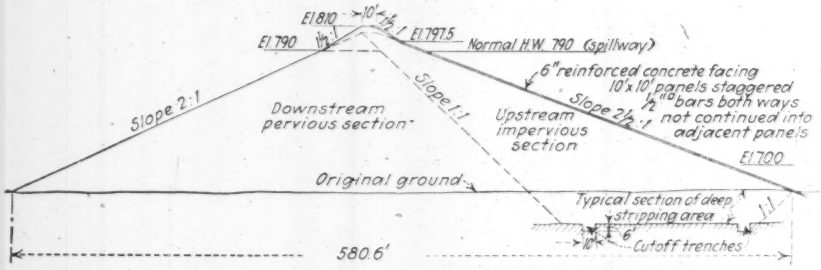
Material—The impervious section of the dam was built with fill found in a small side canyon at an elevation slightly above the valley floor. Its delivery involved an average mass haul of about 2,200 ft. As construction progressed, it was found that material on the hills upstream from the dam was suitable, consisting of terrace gravels containing clay in sufficient quantity for use in the impervious section. This was an advantage for the contractor, as it provided about 300,000 cu.yd. at a reduction in mass haul of about 1,200 ft. The borrowpit for the pervious material was located in the reservoir floor adjacent to the dam and consisted of sand and gravel valley fill.

Stripping—Bedrock under the east end of the dam was covered by an ancient stream channel passing under a terrace of gravel. Drilling indicated that bedrock in this section was deep as in the present stream cha at the central section of the dam. T complicated the construction proble and increased the estimated yardage the structure because much of the ma rial on the eastern side, particularly the upstream portion where the i pervious material was to be deposit had to be moved and replaced with material.

Under the impervious section stripping was carried to bedrock, a two cutoff trenches 6 ft. deep by 10 wide were excavated and backfilled wi the selected material. Under the per ous fill the site was cleared but n stripped.

Outlet—The outlet conduit consists a 64-in. welded-steel pipe with a 2-i lining of concrete. This conduit w laid in trench and was incased with 12-in. minimum covering of heavily re inforced concrete.

The outlet tower is of reinforced co crete 135 ft. high and is provided wit gates at different elevations. Regulatio of discharge during ordinary operatio will be controlled by small gates locate in a gatehouse near the downstream end of the conduit. Gates in the tower will be used only in case of emergency. Five 24-in. gates are also provided at the outlet of the conduit for emergency unwatering of the reservoir.



The Santiago Creek dam is 130 ft. high and 1400 ft. long at the crest.

The spillway is of a flat-crested open-channel type, with lip 192 ft. long. It is designed to discharge 24,000 sec.-ft. for a 15-ft. depth of overflow, which leaves a 5-ft. freeboard. Such a flood would be about double the estimated flow of record. The spillway and discharge channel are constructed of reinforced concrete.

Excavating and Placement—Borrowpit excavation was done by power shovels, numbering as high as seven during maximum operations, and one dragline. Although material provided easy digging, the output of the shovels was not exceptional. Practically all material was transported from borrowpits to dam by truck or by large-capacity two-wheel carts drawn by tractors. A belt conveyor was used during the early stages, but it handled only a small part of the total fill.

The belt conveyor was installed to transport material from a borrowpit

Sheep-foot rollers were used to compact the fill. A belt-conveyor system was used to deliver part of the filling material, but most of it was hauled in by trucks and tractor-drawn carts.

close to the dam at about streambed level. During the early stages it worked successfully, as it did not require much rising grade; later, as the fill advanced and more elevation was required, an attempt was made to raise the discharge end of the conveyor line. This did not prove successful, as the grade on the belt soon became so steep that a back movement of the material resulted. Had the conveyor been applied to bringing clay from the pits over the hill to a point above the level of the top of the dam, where the material could have been chuted into trucks for distribution on the fill, it might have proved a more feasible layout.

The conveyor system was lacking in flexibility at the loading or borrowpit end, where two shovels were used to load the belt through a portable hopper. This operation worked well until the second cut had to be started in the pit. Then the two shovels had to be shut down for an average of about eight hours while the feeder section of the conveyor was moved over for the new cut.

During the period the conveyor was in operation it moved a total of 90,000 cu.yd. of material at an average of 147 cu.yd. per hour. Subsequently an attempt was made to use a conveyor for moving pervious material from the upstream valley floor to the dam, but the layout did not prove successful and only 700 cu.yd. of material was handled.

There seemed to be two principal difficulties in the use of a conveyor system for transporting material for such an earth dam. First, the lack of flexibility in the system makes it difficult to load and discharge without interruption. Second, the nature of the operation makes all equipment and construction procedure dependent on a single unit, and in case of a breakdown all major functions are stopped.

Filling—The rate of placing material in the dam was exceptionally rapid, and about 1,000,000 cu.yd. was deposited in a three months' period. The monthly record was as follows: prior to Aug. 1, 1931, 59,704 cu.yd.; August, 399,439 cu.yd.; September, 286,190 cu.yd.; October, 208,699 cu.yd.; November, 59,733 cu.yd. Of this total of 1,103,079 cu.yd. of material, the contractor placed 51 per cent with carts, including the yardage transported by conveyors, and the rest was hauled by trucks. An interesting item of construction information is the fact that the daily wagon count of yardage averaged 2.2 per cent less than the yardage determined by cross-sectioning. Material was spread in 8-in. layers.

Air view of rolled-earth dam, where 400,000 cu.yd. was placed in one month.

The maximum day's record, which occurred in August, involved the depositing of 16,000 cu.yd. of material, working two ten-hour shifts. Success in depositing at such a rapid rate on so small an area was due to the type of clay material in the impervious section and to the ease with which the sand and gravel in the pervious section could be spread and compacted. The impervious material was a fine silty clay that pulverized readily without special handling. Also it readily absorbed the necessary moisture, applied by sprinkling, which aided in spreading and compacting operations. Compacting was done by sheep-foot rollers and was carried on until light could be seen between the drum of the roller and the ground. Compacting was aided to a large extent by the rolling effect of the wide wheels and the heavy loads of the tractor-drawn cars, which moved loads of about 12 cu.yd.

Daily tests for moisture and weight of material were made from the compacted fill. Laboratory tests made prior to construction were used as checks for these progress tests and indicated that maximum compaction was being obtained.

The clay material varied somewhat in clay and silt content, and the daily tests in the field laboratory were the governing factor in obtaining maximum compaction. Within half an hour after taking a cylinder sample from the fill the results were in the hands of the resident engineer for test, and the sprinkling was regulated to meet the proper requirements. The weight of compacted material in the impervious fill varied from 124 to 130 lb. per cubic foot, and the required moisture varied from 11 to 17 per cent.

Quantities—The impervious section of the dam contains 581,460 cu.yd., and the pervious section 522,306 cu.yd. of material. Total stripping done on the site amounted to 238,411 cu.yd., and 121,498 cu.yd. of this stripped material was incorporated in the pervious section of the structure.

The upstream concrete paving was placed on an area of about 10 acres in extent and contains 8,780 yd. of concrete. The spillway and channel construction required 3,960 cu.yd. of concrete.

The present structure, in which The Irvine Co. is half owner, is the second earth dam constructed on the ranch during the past year; a third dam is proposed for construction during 1932. With completion of the latter structure, there will be little runoff from the 100,000-acre ranch, except at times of extreme floodflow, which will not be conserved in these three reservoirs. No similar area in California will have so completely conserved and developed its water resources.

Engineers and contractors

Organization—The dam and appurtenant structures were designed by A. Kempkey, consulting engineer, San Francisco. Preliminary surveys, topography, establishing of the grid system for control in cross-sectioning and exploration work were done by the engineering department of The Irvine Co. under the direction of the author. D. W. Albert was resident engineer. R. G. LeLourneau, Inc., was general contractor for the structure, with Penn Watson superintendent.

Loss of Head at Branches Determined for Water Pipes

Translated in abstract form by
Eugene E. Halmos
Consulting Engineer, New York, N. Y.

A LARGE NUMBER of experiments have been conducted recently at the hydraulic laboratory of the Technical University of Munich, Germany, with a view to determining the loss in head that occurs at the junction of a branch with a straight run of pipe, both for divergent and convergent flow. The description of these experiments and the analysis of the data obtained are contained in a paper by Emil Kinne, published in Vol. 4 (1931) of the *Proceedings* of the hydraulic institute of the Technical University edited by Dr. D. Thoma.

The notation used is indicated on Fig. 1 for the case of separation of the main stream and on Fig. 2 for the unification of the stream of a branch with that of a straight run. It will be seen that the diameter of the straight run of pipe, d, is constant throughout and the diameter of the branch is denoted by d_b.

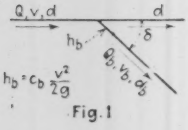


Fig. 1

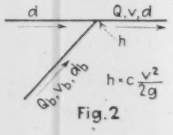


Fig. 2

The following notations apply to Figs. 1 and 2:

Q = total discharge in straight run of pipe.

d = diameter of straight run of pipe.

v = velocity corresponding to Q in straight run of pipe.

Q_b = discharge carried by branch pipe.

v_b = velocity corresponding to Q_b in branch pipe.

d_b = diameter of branch pipe.

$h_b = c_b \frac{v^2}{2g}$ loss in head at entrance to branch pipe in case of divergent flow.

c_b = coefficient determined by experiment for divergent flow.

$h = c \frac{v^2}{2g}$ loss in head in straight run just beyond junction of branch pipe in case of convergent flow.

c = coefficient determined by experiment for convergent flow.

δ = angle of divergence or convergence.

Studies have been made for three ratios of $\frac{d_b}{d}$—namely, .349, .581 and 1.0. The angles between the straight run and the branch were 90, 60 and 45 deg. One set of experiments was made on pipes with sharp-edged junctions and another set with rounded junctions where the radius of the rounding was 0.1 d_b. From the data furnished by the experiments the most efficient diameter ratios (characterized by minimum values of the coefficients c_b and c) were established for the three angles of divergence or convergence and for several ratios of the discharge carried by the branch to the total discharge. The accompanying tables show the results obtained.

With the use of the data given in the tables it should not be difficult to find the values of the constants c_b and c for other volume ratios or other angles of divergence or convergence than those given in the tables.

TABLE I — SEPARATION OF TWO STREAMS

Most efficient branch diameter d_b with given angle of divergence δ and given volume ratio Q_b/Q for sharp-edged and rounded junctions ($r = 0.1\ d_b$)

Angle of divergence deg. δ	$Q_b/Q = 0.3$		$Q_b/Q = 0.5$		$Q_b/Q = 0.7$	
	Sharp-edged	Rounded $r = 0.1\ d_b$	Sharp-edged	Rounded $r = 0.1\ d_b$	Sharp-edged	Rounded $r = 0.1\ d_b$
90	$d_b = d$ $v_b = 0.3v$ $c_b = 0.85$	$d_b = d$ $v_b = 0.3v$ $c_b = 0.76$	$d_b = d$ $v_b = 0.5v$ $c_b = 0.87$	$d_b = d$ $v_b = 0.5v$ $c_b = 0.74$	$d_b = d$ $v_b = 0.7v$ $c_b = 1.0$	$d_b = d$ $v_b = 0.7v$ $c_b = 0.8$
60	$d_b = d$ $v_b = 0.3v$ $c_b = 0.7$	$d_b = 0.61d$ $v_b = 0.8v$ $c_b = 0.59$	$d_b = d$ $v_b = 0.5v$ $c_b = 0.59$	$d_b = 0.79d$ $v_b = 0.8v$ $c_b = 0.54$	$d_b = d$ $v_b = 0.7v$ $c_b = 0.57$	$d_b = d$ $v_b = 0.7v$ $c_b = 0.52$
45	$d_b = 0.58d$ $v_b = 0.9v$ $c_b = 0.43$	$d_b = 0.58d$ $v_b = 0.9v$ $c_b = 0.35$	$d_b = d$ $v_b = 0.5v$ $c_b = 0.42$	$d_b = 0.75d$ $v_b = 0.9v$ $c_b = 0.32$	$d_b = d$ $v_b = 0.7v$ $c_b = 0.34$	$d_b = d$ $v_b = 0.7v$ $c_b = 0.3$

TABLE II — UNIFICATION OF TWO STREAMS

Most efficient branch diameter d_b with given angle of convergence δ and given volume ratio Q_b/Q for sharp-edged and rounded junctions ($r = 0.1\ d_b$).

Angle of Convergence, Deg. δ	$Q_b/Q = 0.3$		$Q_b/Q = 0.5$	
	Sharp-edged	Rounded	Sharp-edged	Rounded
60	$d_b = 0.58d$ $v_b = 0.9v$ $c = 0.475$	$d_b = d$ $v_b = 0.3v$ $c = 0.33$	$d_b = 0.58d$ $v_b = 1.5v$ $c = 0.637$	$d_b = 0.58d$ $v_b = 1.5v$ $c = 0.563$
45	$d_b = 0.58d$ $v_b = 0.9v$ $c = 0.2$	$d_b = 0.58d$ $v_b = 0.9v$ $c = 0.2$	$d_b = 0.58d$ $v_b = 1.5v$ $c = 0.425$	$d_b = 0.58d$ $v_b = 1.5v$ $c = 0.425$
	$Q_b/Q = 0.7$		$Q_b/Q = 1.0$	
	Sharp-edged	Rounded	Sharp-edged	Rounded
60	$d_b = 0.58d$ $v_b = 2.0v$ $c = 0.715$	$d_b = 0.58d$ $v_b = 2.0v$ $c = 0.655$	$d_b = d$ $v_b = v$ $c = 0.645$	$d_b = d$ $v_b = v$ $c = 0.53$
45	$d_b = d$ $v_b = 0.7v$ $c = 0.540$	$d_b = d$ $v_b = 0.7v$ $c = 0.525$	$d_b = d$ $v_b = v$ $c^* = 0.38$	$d_b = d$ $v_b = v$ $c = 0.38$

Low-Cost Sewage Plant Made Possible by Building New Intercepter

New sewer permits discharge of effluent into New York barge canal, thereby avoiding the expensive treatment that would be required if the discharge into a small stream had been continued

By Henry W. Taylor
Consulting Engineer, New York City

BY CHANGING the point of sewage discharge from a small stream of low flow to the New Yrok barge canal, the city of Rome, N. Y., avoided the use of expensive secondary treatment for its sewage and has been enabled to build a low-cost plant. The bed of the old Erie Canal was utilized for the necessary new interceptor. The plant now in use comprises settling tanks, sludge-digestion tanks and sludge-drying beds.

A separate sewer system was installed in Rome in 1905. The trunk sewer flowed westward, discharging into a small stream known as Wood Creek at a point 10,000 ft. west of the city line. During dry weather the sewage discharge was about equal to the streamflow, and the resulting situation was highly undesirable. The city of Rome has in the past paid about $15,000 per year in damages to riparian owners on Wood Creek, amounting in the aggregate to nearly $200,000.

The population of Rome is about 30,000, with water consumption and sewage flow at present 5,000,000 gal. daily. Various projects for purification of this sewage have been prepared, all involving a sufficient degree of purification to warrant discharge of the effluent into the meager waters of Wood Creek, but at a cost of about $800,000. As the dry-weather flow of Wood Creek is so small, it is evident that a high grade of effluent would be required of such a disposal plant, and the high cost of these projects is easily understood. A purification plant at Wood Creek would also involve the risk of renewed applications for damages in case of a temporary failure of efficiency of the plant.

However, it happens that the city lies on a divide between two watersheds, and while the streams to the west are of small proportions, the Mohawk River is available to the east. The river has been canalized by the state and forms a section of the barge canal. It is under state regulation, and the city has access to a regulated flow of 200 sec.-ft. This quantity provides an ample dilution for a sewage flow of about 8 sec.-ft. The main requirement in connection with discharging sewage into the barge canal consists of preventing sludge banks, which would interfere with navigation and produce a nuisance. The canal is not used as a water supply, and a high degree of effluent is not required. The principal demand on a disposal plant consists of settling the sewage under velocities lower than the velocities in the canal, so that whatever settlement takes place will be confined to the sewage tanks. Of course all floating matters, oils and greases must also be removed.

A satisfactory point of discharge of treated sewage into the barge canal lay to the east of the city, however, and a reversal of the existing trunk sewer development was involved in any scheme for use of the Mohawk River for final disposal.

No secondary treatment is provided at the new Rome, N. Y., sewage plant. The building shown adjacent to the settling tanks contains the office, laboratory and pumping equipment for sludge and sewage. Drying beds are behind the sludge tanks in the background.

Interception of sewage

Fortunately, the bed of the old Erie Canal extends through the business district of the city. It provided a location for the new trunk-sewer development that did not involve the removal and replacement of permanent pavements. In addition to this fortunate condition, the New York Central Railroad Co. owns a right-of-way for industrial trackage, extending from this canal bed in an easterly direction for 13,000 ft.

These two factors taken together furnished a location for a new interceptor and trunk sewer, which now delivers the sewage from Rome to a disposal site located east of the city and adjacent to the barge canal. The city obtained from the railroad company a right-of-way for construction and maintenance of trunk sewers on their property.

Seventy-five per cent of the sewage is intercepted by a sewer extending along the old canal bed and is carried by gravity to a main pumping station. The remaining 25 per cent lies in a low-level district below the canal bed. This district is now served by the existing trunk sewer, which has been bulkheaded, and a low-level pumping station, which lifts the low-level sewage to the high-level interceptor. At the main pumping station all of the sewage, excepting that from one sewer district, is lifted 12 ft. so as to make the barge canal available for disposal and also to avoid excessive and expensive cuts.

Treatment plant

The sewage-treatment plant consists of three settling tanks averaging 7 ft. deep and equipped with parallel sludge collectors. Adjacent to these tanks is an office building in which have been installed sludge pumps, dewatering pumps and a water-supply pump for a local pneumatic water system, a sludge and dewatering well and a water-supply well. In the building there is also an office and laboratory and chlorine equipment for emergency use.

The sludge from the sludge pockets of the settling tanks is blown off to the sludge well and then pumped to the sludge-digestion tank. Two sludge tanks are provided, one heated tank with a floating cover for digestion, and one for sludge storage. The storage tank will be used during difficult weather or when no sludge-bed area is available for immediate use. It is doubtful, however, if this tank will ever be used to any great extent. Back of the sludge tank is located the sludge bed, divided into ten sections, with a total area of 40,000 sq.ft. On the north side of the sludge beds a depressed roadway has been constructed, so that the sludge scraped from the beds can be conveniently pushed or shoveled into trucks.

Sludge-heating plant

The sludge-heating plant consists of a gas-fired heater having seven burners, each with a capacity of 80 cu.ft. of gas per hour. The heating coils are of 2-in. welded copper tubing and are provided

with a circulating pump having a capacity of about 16 gal. per minute. The boiler was set 8 in. above the floor, so that in starting the sludge-digestion process the gas burners could be removed and heat could be supplied by temporary vertical kerosene burners until such time as sufficient gas is available.

The plant was put into operation in November, 1931, and from December it has been operated on a regular schedule. About the middle of December the heating of the tank was started, gas production started on Jan. 1, 1932, and on Jan. 20 it amounted to 4,000 cu.ft. per day. Production of gas is increasing at the rate of 300 cu.ft. per day. It will soon be possible to start two of the gas burners, leaving only one of the kerosene burners as temporary assistance.

Samples of the effluent from these settling tanks have shown no settleable solids in an Imhoff cone that could be read on the scale. The sludge collectors are operated for one-half revolution twice a day, in the morning and afternoon. The volume of fresh sludge removed averages 750 cu.ft. of wet sludge, or 25 cu.ft. per day per capita. The parallel sludge collectors return on the surface of the sewage and skim the tanks to the outlet end. The daily skimming required at this location has not proved to be a serious matter. A recording effluent weir has been put into operation and will record the flow of sewage through the tanks. The pumping plants are automatic and are visited twice a day for inspection, oiling and greasing, but are otherwise without attendance.

The cost of the disposal plant proper, as determined by unit prices segregated from a lump-sum bid, is estimated at $100,000. The plant as it stands is designed for 40,000 people, and the unit cost is, therefore, less than $3 per capita. The trunk sewers consist of 20,000 ft. of tile, concrete and segment-block sewer from 15-in. to 42-in. in size.

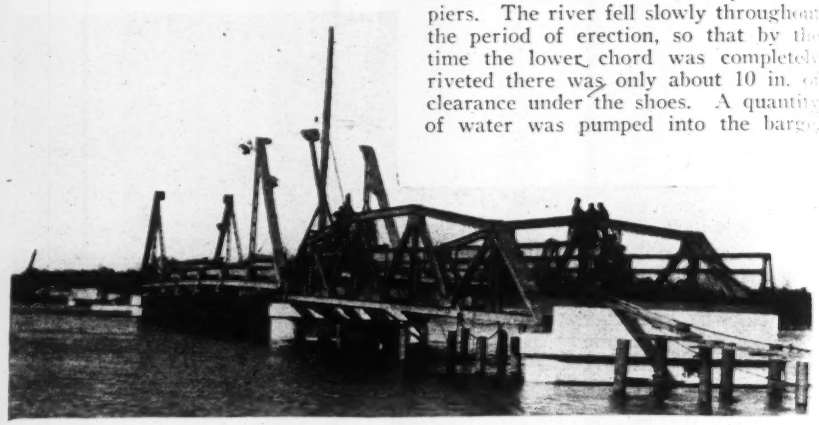
These trunk sewers, together with the cost of land, engineering and legal expenses, constitute the cost of the remainder of the project, and the total cost, including all items, amounts to less than $305,000. The sewage works are designed for 40,000 people, but area has been allowed for additional units to double this capacity. Trunk sewers are designed for a population of 80,000. The whole project was installed at a cost of about $10 per capita, and development for a future population will reduce this unit cost to about $5.

The disposal works is operated by a superintendent with one assistant and is under the supervision of the engineering department of the city and the consulting engineer. The contractor for the work was Antonio DiMarco, of White Plains, N. Y., together with the H. J. Brandeles Corp., of Utica, N. Y. The heating plant and accessories were installed by the city.

Steel Delivery Barge Serves as Falsework in Erecting Bridge Span

By Soule Butler
Assistant Engineer, Louisiana Highway Commission, Baton Rouge, La.

FLOOD STAGES in the Ouachita River, which occurred during the erection of a new steel bridge at Sterlington, La., and made the use of pile falsework temporarily impossible for one of the spans, caused the contractor to adopt the novel expedient of assembling the span on the barge in which the steel was delivered. The barge, which was 26 ft. wide, 175 ft. long and 10 ft. deep, contained all the steel for the four-span bridge, so loaded that erection could be carried on from east to west—first a 100-ft. span, then a 200-ft. span followed by two 100-ft. spans. The east 100-ft. span had been erected on pile falsework, a 5-ton bridge traveler being used, when the flood occurred. Since the water was within a few feet of the top of the piers, it was impracticable to drive falsework piles and brace the 40 ft. of unsupported length as required for the 200-ft. span. The contractor had the alternatives of erecting the span on the barge or of unloading the steel on the bank and waiting for the flood stage to pass. He chose the former as more economical.



Erecting 200-ft. span of Louisiana state highway bridge at Sterlington on steel barge in which steel was delivered to site.

The traveler was moved out to the west end of span No. 1, and the barge was floated downstream, endways, in front of the traveler. Heavy timbers were laid transversely across the top of the barge so as to come at the intermediate panel points of the span and balance the barge. Sufficient blocking was used to secure the proper camber and grade, so that all shoes would come to rest on their respective piers at the same time. The floor system was then assembled by starting on the downstream end and working upstream. Considerable moving of the barge was necessary to bring the required members within reach of the boom, but by pulling the barge back and forth in front of the traveler all of the floor steel as well as the end posts and hip verticals were placed. The barge was then floated into place between the piers, as shown in the accompanying illustration, and the traveler was moved out on the stringers, where erection continued in the customary manner. All joints were filled with 50 per cent bolts and 50 per cent drift pins, so that the span could be swung if the water went down before the bottom chord was riveted.

When erection started there was about 3 ft. of clearance between the bottoms of the shoes and the tops of the piers. The river fell slowly throughout the period of erection, so that by the time the lower chord was completely riveted there was only about 10 in. of clearance under the shoes. A quantity of water was pumped into the barge with the intention of releasing the blocking and placing the span on the piers, but it was decided that this could be accomplished more quickly with jacks, and this latter method was adopted.

The engineers in charge were of the opinion that the cost of erection was less than it would have been had the contractor erected the steel on falsework piling. The span was erected and the barge removed in nine working days.

Koss Construction Co., Des Moines, Iowa, was the general contractor. The steel was fabricated and erected by the International Steel Co., Evansville, Ind., of which G. H. Allen is chief engineer and R. T. Nichols job foreman. Plans and supervision of erection were executed under the direction of N. E. Lant, bridge engineer, for the Louisiana highway commission. E. L. Erickson, assistant state bridge engineer, was in charge of construction, with J. E. Jarman as resident engineer. The writer was temporarily assigned to the project as assistant resident engineer.

Cutting the Accident Rate on a Large Building Job

Intensive safety instruction and inspection and intelligent use of accident-prevention devices on new Ohio State office building at Columbus reduced accident-severity rate to one-fifth of normal for building construction

By E. P. Martin
Safety Engineer, Struck Construction Co. Columbus, Ohio

IN VIEW of the explosion on April 14 in the basement of the new Ohio State office building in which ten men were killed and more than fifty injured, the publication of this article requires a word of explanation. The explosion occurred after the building was virtually completed. Believed to have been caused from an accumulation of gas of unknown origin in a closed sub-basement, the explosion represents an entirely separate subject from that of accident prevention. A notably low accident occurrence characterized the job as a building operation, and a delineation of the methods by which this was achieved forms the subject matter of the following article.
—EDITOR.

FROM THE TIME that actual construction work commenced on the Ohio state office building until the present time, the contractors have stressed safety and strict compliance with the requirements of the safety code of the Industrial Commission of Ohio. Up to Jan. 31, 1931, a total of 807,400 man-hours had been worked on the job, with only 25 lost-time accidents, amounting to a total time loss of 9,520 hours. Of this total, some 2,000 hours are charged against one accident in which a carpenter, in lifting 4x4-in. shores, sprained his back so severely that it has resulted in our most serious accident.

As safety engineer, it has been a pleasure to find that the workmen were much interested in the record as it was posted at different places on the job for their observation. The bulletins posted showed the number of hours worked, the number of lost-time accidents and, in addition, bore instructions and slogans that were designed to keep the minds of the workmen on safety.

Safety inspection

Early in the campaign for safety the safety engineer met with the men and talked to groups that gathered in tool rooms and check rooms before work time and on rainy days when they were driven to cover. These talks were instructive and brought out specifically the hazards that prevailed on the job at that time. The men were urged to report any hazards that they might observe on the work. It was found that when one group or one subcontractor was forced to comply with the safety code, they would check up on other trades and would report their violations. Day-by-day search was made, not only for violations of the state safety code but for the more simple violations of common sense in construction. The safety engineer spent most of his time out on the job, observing the actual construction, cautioning the men when necessary, warning them of hazards and looking after their safety in general.

Accident-prevention devices

Many signs were made and posted on the work. Red-oilcloth flags bearing the signs of Caution and Danger were hung where hazards existed and such signs as

CAUTION: MEN WORKING BELOW
DANGER: CONCRETE HOIST
GUARD-RAIL: DO NOT REMOVE

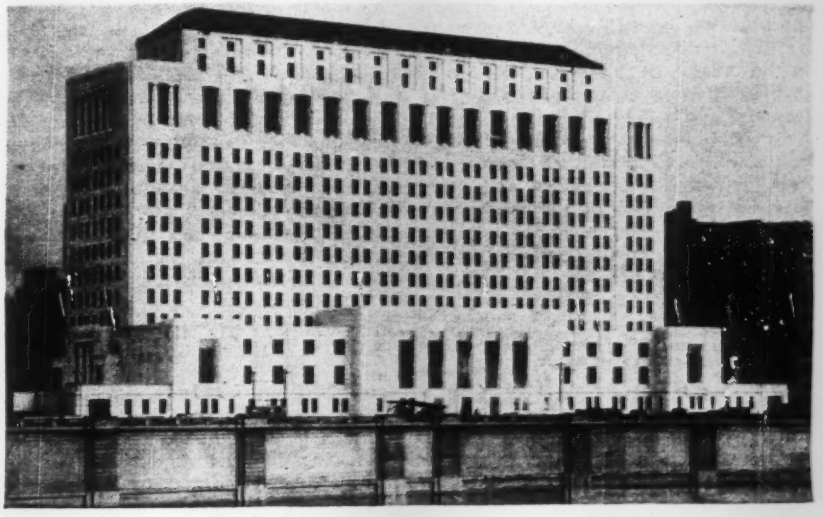
were also made and erected, as well as numerous signs that were furnished by the department of safety and hygiene of the Industrial Commission of Ohio.

A suitable first-aid kit was installed in the office so that immediate first-aid might be given the injured, in some cases this being all the attention that was required. A great many minor injuries were treated in this way, and, due to this safety measure, none of the cases so treated developed infection. All equipment was inspected before being put in operation, such as wire cables and sheaves on steam shovels, derricks, concrete mixers, concrete towers and material hoists. Employees who handled cement in inclosed places were provided with both goggles and respirators. Steel workers who used torches for burning or trimming steel were provided with colored goggles, their ladders and riveting platforms were inspected and kept clean, and good housekeeping was practiced throughout the job.

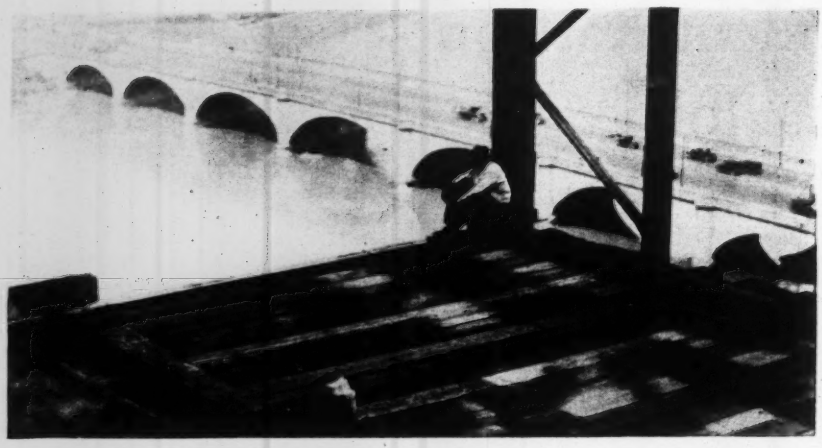
The Detroit Steel Erection Co., which erected the steel, provided sufficient 3-in. plank to cover two entire floors of the building. This gave the erectors safe access to their work and gave ample protection to other tradesmen working on the lower floors. Riding on loads of steel or on the hook and ball of the derrick was not permitted, and the entire 3,578 tons of structural steel was erected without a lost-time accident.

Cables and sheaves were inspected at intervals, guards were built around cables that were in close proximity to other workmen, or where runways were close to or across the lines of cable. Electric current for the operation of the derricks, compressors and hoists was carried through heavily insulated waterproof cables, and the switches and meters were inclosed in substantial cabinets that were kept padlocked. Large red danger signs, showing the voltage, were stenciled on these cabinets as well as on the tight high-board fence that was erected around the transformers through which the current passed.

By the time the structural-steel work had progressed to the fifth-floor level, the Hughes-Keenan Co., of Mansfield, Ohio, had commenced the erection of the steel stairs, and this practice was followed as fast as the work progressed, thereby making easier and safer access to the upper floors. Wood treads were installed temporarily on the stairs so that workmen would not turn their



Scioto River front of new office building that will house all state departments at Columbus, Ohio.



Corner of eleventh floor, showing close planking maintained on steel-erecting floors as the building went up.

ankles or slip on the steel nosing of the risers. Temporary hand-rails of 2x4's were also erected.

As the steelwork progressed, the general contractors erected their steel concrete tower in one of the elevator shafts so that work could be started on the concrete floor slabs and on the concrete fireproofing on the steel columns and beams. On each floor the tower was protected by placing 2-in. poultry netting around it for a distance of 6 ft. from the floor, and suitable signs were erected to warn the workmen to stay out of the shaft.

Saw-guards were used on the three portable gasoline-operated saws that were used in making beam sides and bottoms on the ground floor and outside the building. These forms were then hoisted to the floors on which they were to be used. The cables and sheaves of these hoists were frequently inspected, and substantial railings were erected to guard the space where workmen received the material on the upper floors.

During the erection of the concrete formwork and also during the wrecking after the concrete had been poured, the safety engineer was especially insistent upon the use of safe scaffolds, particular attention being given to the scaffolds on the outside bays where a fall would have resulted in a serious, if not fatal, accident.

As concrete floors were poured, guard-rails were placed around all elevator and stair openings, pipe shafts and other openings in the floors for the protection of the workmen.

Near the center of the building are eight elevator shafts, four on each side of the corridor. Those on the east side were utilized as spaces for the material hoists and concrete tower. The hoist in shaft 1, operated by the general contractor, was also used by several of the subcontractors for hoisting materials and tools. In order to prevent the possibility of anyone giving a signal from a floor other than the one on which the cage was being loaded or unloaded, an electric signal bell was installed on the cage of the hoist so that the signal had to be given from the floor on which the cage was stationed. This prevented anyone on another floor from moving the cage while it was being loaded or unloaded, and, due to this precaution, there were no accidents on this cage. Safety gates made of 2x4-in. timbers and 2-in. poultry netting and hung with counterweights were installed at every floor and were kept closed when the cage was not stationed at the floor. Each gate bore a danger sign and a card showing the proper signals for raising or lowering the cage. A card bearing this information was also posted beside the bell on the hoist.

After the tile partitions were built and the natural light was shut off from the stairways, temporary electric-light wires were installed in all stairways, and a light was placed on every landing to make the stirways safe. No debris was allowed to collect in stairs or corridors. Corridors were also kept well lighted during working hours.

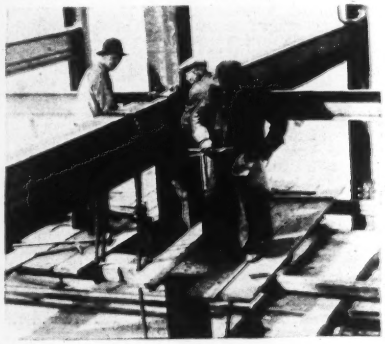
Since the installation of two of the permanent elevator cages in the shafts, these are being used as material hoists and passenger elevators for the workmen. Temporary doors of the bellows type have been applied to every door of these shafts. These doors are made of heavy canvas, almost as wide as the opening, with horizontal wood strips 2 in. wide and about 18 in. apart. The ends of these strips run in guides at the door jambs. The doors are collapsed by means of a piece of sash cord attached to the bottom rail, then passed up through a pulley at the top of the frame inside the door, with a loop on the end of the cord that the operator can reach from the inside only to open the doors. On the corridor side of the door in 2-in. red letters is stenciled the sign: Danger: Do Not Open. These doors have been very satisfactory, and we have had no accidents on these elevators up to this time.

When plastering was commenced the plastering contractor's scaffold builders were instructed regarding the type of scaffolding prescribed in the safety code. This has been adhered to, with the result that no one has been injured on their scaffolds. The same is true of the marble setters, who have had considerable work on high scaffolds in the first story concourse. These scaffolds have been well constructed, with crossbracing and substantial ledgers and bearers of new material used throughout.

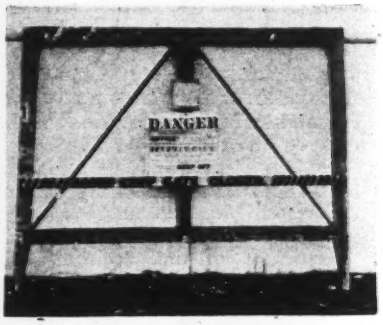
The exterior Georgia marble facing (90,000 cu.ft.) was set by the Wilson-Winfrey Co., of Shreveport, La., without any serious accidents. All the equipment was frequently inspected and was kept in good condition at all times. The company used a hanging scaffold equipped with guard-rails and toe boards around the entire building.

Accident records

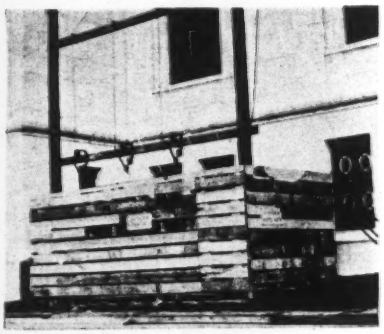
After the safety engineer had been on the job for 30 days, the record



Scaffolds were provided for all riveting crews and were hung from steelwork by manila rope.

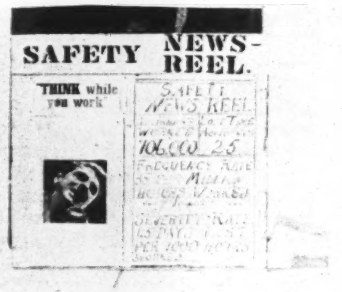


Safety gates were used on each floor at every material hoist.



Transformers were inclosed and danger signs were posted on crating.

Workmen chipping concrete were required to wear goggles.



Accident-record bulletin board for information of workmen.

showed a total of 57,520 man-hours worked, with only one lost-time accident that resulted in eight hours' time loss. With the cooperation of the subcontractors and their employees, the good record was kept up until, at the end of 60 days, the safety bulletin showed 104,000 man-hours worked and still only eight hours' time loss.

With 325 to 380 men working daily, a few more lost-time, but not serious, accidents crept into the record, until on Sept. 1 the record stood at 492,200 hours worked, with only nineteen lost-time accidents. On Oct. 1, 1931, the record shows 559,800 hours worked, with 23 lost-time accidents, entailing a total time loss of 6,600 hours; and on Dec. 31 the record showed 760,000 hours worked, with only 25 lost-time accidents, resulting in 8,000 hours lost time. Of the 25 lost-time accidents only sixteen were compensative cases, causing a loss of seven days or more. The causes of these accidents were as follows:

Struck by falling objects	3
Striking against objects	4
Sprained backs	3
Foreign bodies in eyes	1
Falls from staging	1
Sheaves and cable	1
Hernia	1
Nail punctures	1
Struck by hoist	1
Total	16

This list bears out the old ratio of causes of accidents, the first three items being most common. Nail punctures were held to a minimum through the general contractor's system of cleaning lumber as it was wrecked from the formwork and the insistence of the safety engineer in keeping aisles or runways free from debris.

The above record shows the severity rate (the number of days lost per 1,000 man-hours worked) to be only 1.3. Comparing this with the average severity rate of 6 on construction work of this nature, it may be seen that an accident-prevention campaign really brings results.

Welding New Floor Systems to English Bridges

Shop-fabricated in full-width units 10 ft. long, new floors were installed without interrupting railway traffic

WELDING as an effective and convenient method of strengthening bridges was adopted for two double-track through plate-girder bridges near South Shields (England) on a heavily traveled suburban line of the London & Northeastern Railway. While the girders were of ample strength, the floor systems were inadequate for the heavy loading of modern equipment. The construction of the new floor systems (Figs. 1 and 2) is described in the *Railway Gazette* (London), from which the following particulars are summarized.

Old widely spaced floor beams were replaced by 18-in. I-beams 5 ft. apart, each reinforced by top and bottom coverplates welded to the flanges. The ends of these beams were welded to the girder webs and to bearing plates on the bottom chord flanges of the girders, while gusset plates were welded to the top of the floor beam and the web of the girder. The girders were also stiffened by outside gussets. Between the floor beams were fitted 14-in. I-beam stringers, having the tops coped so that the stringers could be set flush with the floor beams, the ends being seated on and welded to angle-iron stools welded to the bottom flanges of the floor beams. One end of each stringer was welded directly to the web of the floor beam, while the other was welded to a ½-in. filler or patch plate 6½×12¾ in., which was already welded to the floor beam.

A ⅜-in. deck plate forms a solid floor for the ballast and is covered with an asphalt layer, sloped for drainage. A vertical plate 21 in. high, to retain the ballast, is welded to the deck and braced by struts, which are welded to the plate and the girder web.

Unit fabrication in shop

The new floor system was assembled and electrically welded at the railway shops in units, each comprising two floor beams with the stringers between them and the deck plates over all. The two tracks and the ballasted deck were removed, and temporary tracks were laid consisting of 10-ft. rails on 10-ft. longitudinal timbers connected by transverse timbers. These longitudinals rested on the old floor beams. With a 10-ft. section of each track removed, the old floor beams exposed were cut out with torches, so that a unit of the new floor system could be set in place. This

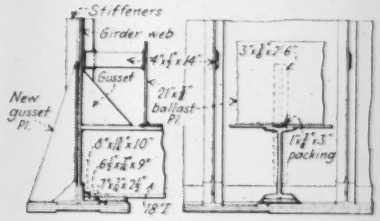


Fig. 1—New floor beams reinforced by welded coverplates are welded to old bridge girders.

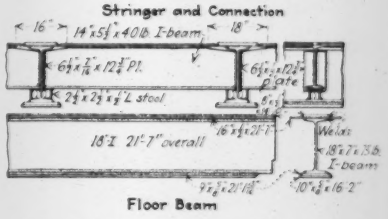


Fig. 2—Above, I-beam stringers welded between floor beams and carrying welded deck plates. Below, I-beam reinforced by coverplates welded to flanges.

placing was done during intervals of four hours between trains in the early morning of week days and five hours on Sundays. The welding of the new floor beams to the girders was then accomplished after the temporary tracks had been replaced.

Except for the periods mentioned, the intervals between trains average 8 min., or 5 min. during the rush hours. Placing and welding the alternate lengths of stringers and deck plates between the units already in place was done without interrupting traffic, but trains were required to reduce speed over the bridges. As a final step, stone ballast was placed, and the regular track construction was laid.

Oil-Processed Road Maintenance, New Mexico

Cost data summarize maintenance activities extending over a 3½-year period and including no road less than six months old

By William C. Davidson
Formerly State Highway Engineer of New Mexico, Santa Fe, N. M.

WATER is the inveterate enemy of the light bituminous-surfaced road. In placing prime emphasis on this fact the following article impresses a lesson on the roadbuilder which observation often shows has been unlearned. The fact most commonly overlooked in these instances seems to be that it is not only soaking wetness that needs to be eliminated but also moderate moisture. Capillary moisture rising to the surface mat may easily be a more dangerous factor than frequent surface drenchings of a well-sealed and well-drained light bituminous surface. The article is altogether a practical discussion of an important roadbuilding method by an engineer of experience.
—EDITOR.

ACCORDING to statistics recently compiled by the New Mexico highway department, the annual maintenance cost of about 600 miles of oil-processed roads has been $230 a mile. Of this amount $160 was expended in the upkeep and repair of the oiled mat itself. The remaining $70 was paid for miscellaneous repairs to roadbed, shoulders, side ditches, drainage structures, road signs, route markers and for the removal of snow and vegetation.

The roads under consideration have been in service from six months to three and one-half years; the report does not cover the maintenance of any road that has not been completed and in use for at least six months, as the upkeep during the earlier months following completion is practically negligible. The projects under maintenance three and one-half years represent the first units completed under the oiling program initiated during the first half of 1928.

Out of a total maintenance expenditure of $238,500 covering the period from June, 1928, to Jan. 1, 1932, the report shows cost percentages apportioned to the several items as follows:

Top surface or oiled mat	70.8
Shoulders and ditches	19.7
Drainage structures (bridges, culverts, spillways, protection ditches and dikes)	5.4
Road signs and route markers	0.2
Snow and vegetation removal	3.9

The maintenance cost, therefore, of the oiled surface, was roughly 71 per cent of the total, while all other items of upkeep aggregated 29.2 per cent. The latter figure would, of course, be common to any type of road surface. The figure to be kept in mind particularly is the cost of $160 per mile, which applies strictly to oil-processed road maintenance.

A fact of outstanding importance revealed by the cost data is the effect of drainage upon maintenance. All of the roads whose maintenance costs were glaringly high were subjected to adverse conditions of moisture and drainage. In some instances the road fills were constructed too low; in others the side ditches and cross-drainage were inadequate, and in still others the subsoil was waterlogged. Any of these conditions, and especially a combination of all of them, is reflected in the cost of maintenance.

Reconstruction is, generally speaking, impracticable, because of the cost. The problem then is to release the moisture in the mat. This is accomplished by scarification and reprocessing. A checking or cracking surface, followed by corrugation under traffic, indicates moisture in damaging amounts. To remove this moisture successfully requires that both mat material and base be exposed to air and sunlight.

This expensive maintenance emphasizes the inexpediency of employing oil-processed construction under all conditions. It further emphasizes the fact that the time to make provision for maintenance is during original construction by giving due consideration to the drainage of the roadbed.

It has been the writer's observation extending over three and one-half years that oil-processed roads, favorably situated as regards drainage and soil conditions, have retained a smooth profile from year to year with practically no tendency to corrugate. It has also been observed that projects not so fortunately situated have required continuous and costly maintenance. The traffic on these roads has been essentially of the same kind and intensity. As an illustration, a certain road in the farming belt of the Rio Grande valley, where the water table is high and the drainage defective, shows an annual maintenance cost of $415 per mile for each year since the road was built. Contrasting with this figure is a maintenance charge of $140 per mile on another arterial road carrying a like volume of traffic but where the soil and drainage conditions are ideal. The roads were both constructed in 1928 and have had practically the same period of service.

Horse-drawn traffic destructive

The destructive action of steel-tired wagons and shod hoofs is well known. This effect is apparent along the edges of the surfacing, which chips and crumbles under the abrasive action of both tires and hoofs. The damaging effect has been combated to some extent by thickening the edges of the mat to 5 in. The normal thickness of the mat is 3 in. This provision of design has materially reduced edge failure and maintenance costs.

Motor grader equipped with scarifier attachment used for maintenance work in New Mexico.

Maintenance processes

The maintenance of an oil-processed surface embraces two major operations: reprocessing and seal-coating. In addition, there will be a certain amount of patchwork in repairing breaks in the surface particularly along the edges of the mat.

Reprocessing is necessary when the mat has become corrugated or otherwise roughened under the action of traffic. It may also become necessary to remix the mat occasionally for the purpose of adding more oil or aggregate. To restore corrugated or irregular surfaces to their original smoothness requires scarification and remixing. Attempts have been made to plane off corrugations with blade machines or with especially designed rotary cutters. The practice has offered no permanent relief. To effect a cure, one must remove the cause, which is the moisture in the mat. No satisfactory plan of removing this moisture, in so far as the writer is aware, has yet been devised other than scarification and drying out.

Even on a well-drained base, corrugations will appear occasionally, thereby indicating the presence of moisture. This condition is due to one of two reasons: (1) that the mat was not properly dried out before being laid down; (2) that the surface was not adequately sealed, allowing moisture to enter from the top.

Sometimes it may become necessary to reprocess an oiled surface in order to add oil or aggregate. A mat containing an excess of oil will bleed and have a tendency to shove due to lack of stability. On the other hand, where the mat is too dry—that is, deficient in oil—the surface will break or ravel under the pound of traffic. The remedy for either condition is scarification and reprocessing, adding either oil or fine aggregate, whichever may be lacking.

The equipment necessary for reprocessing is small. One or more motor-grader units, equipped with scarifier at-

tachments, will suffice, depending upon the size of the job in hand. Likewise, pull-type graders with scarifier attachments and crawler-tractor power are satisfactory. Units of equipment used in maintenance work should be the equal of those units used on construction, as the type of work is identical.

Seal coating

To prevent the entrance of moisture from the top of the road, any oiled mat should have a final seal coat following construction. Thereafter on maintenance a light seal should be applied as the need develops. Experience indicates that a seal coat once every two years will be sufficient in most cases. Special conditions may call for more frequent application.

Surface treatment or seal coating provides the roof for the oiled road. It is very important that it be frequent enough so that the surface will retain its dense and impervious texture. Otherwise the mat will absorb moisture from rain or snow. The application of a seal coat is usually at the rate of $\frac{1}{8}$ gal. or less per square yard. The amount of oil required depends entirely upon the porosity of the mat. Enough seal should be added to fill the surface voids and cracks, so that there will be a minimum of absorption of moisture.

Following the application of the oil, which should be with a pressure distributor, a blotter material should be thrown over the surface, either from previously placed storage piles or from the roadside material itself. In frequent cases where the roadside material has the proper characteristics the blotter material is obtained from the shoulders, ditches or ditch banks, being placed over the surface with hand shovels. Blotter material should preferably be sand or a sand-clay mixture. Heavy soils and clays are unsuited for this purpose.

The oil used in seal coating has been of two grades, a 65-70 and a 70-80; these figures refer to the percentage of asphalt of a given penetration. Results obtained by the use of both these oils have been satisfactory. It appears, however, that the lighter oils give a more non-skid surface than do the heavier oils. Seal coating with heavy asphaltic oils produces a mat of asphalt on the surface, which becomes very slippery in wet weather.

Patching practice

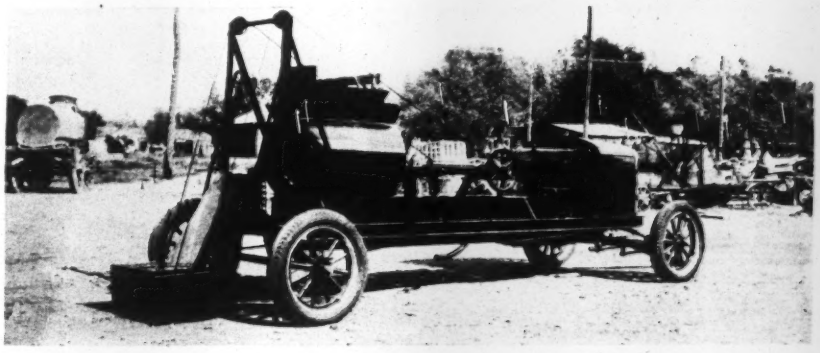
Breaks in the surface of an oil-processed road should be repaired with essentially the same kind of material (oil and aggregate) used in the original construction. These breaks are more numerous along the shoulder lines of the mat than elsewhere, due to passing vehicles turning on and off the surface. When breaks occur it is usually because of base failures or some unusually severe abrasive action of traffic, as in the case of horse-drawn vehicles.

During the construction of a project a certain amount of mixed material is stockpiled for use in future maintenance. It is this material that is used in repairing surface breaks. It has been found that this oiled aggregate, when placed in storage piles, holds its life for a considerable period of time; the loss from depreciation is small. When maintenance supplies have become exhausted, some means must be provided for mixing the oil and aggregate. If the amount required is small, it may be prepared cheaply by hand, using an ordinary mixing board. The usual plan, however, is to employ a power-driven machine, such as a concrete mixer.

It may be of interest to mention a certain type of pug-mill machine that has been developed for premixing maintenance supplies. This machine has proved to be more satisfactory than the methods heretofore mentioned. It was built after the need of comparatively large quantities of patching material developed on certain projects. Briefly, the machine consists of a portable pug mill mounted upon a truck chassis of medium capacity. The pug-mill unit is driven by a small gasoline engine mounted upon the chassis and geared to the blade shaft by means of a chain drive. An oil reservoir at the top of the machine extends the full length of the pug-mill, except for sufficient space left at the rear to permit charging with gravel. A central valve regulates the flow of the oil to the capacity and speed of the mixer. It has a capacity of 3 cu.ft. per batch. The average mixing time per batch is 1 min. The total weight of the unit is 3,000 lb.

Typical patching job along shoulder line of oil-mixed road. Failure was due to poor base, moisture or both.

Portable pug-mill mixer used in the preparation of oiled material for the maintenance of oiled roads in New Mexico. Note oil reservoir at top and rear of machine.



Maintenance easy

The oil-processed road is a type of bituminous construction that lends itself admirably to maintenance. By this is meant that the surfacing may be reconditioned time after time without destroying any of the original properties of the oil or aggregate. The loss from wear and depreciation is almost negligible. The oil will depreciate in quantity and quality, but not the gravel, at least not to any measurable extent.

If the volume of traffic on any road increases to an appreciable extent, demanding a greater thickness of mat, such new demands may be met in a practical way, by reprocessing and adding the new requirements of oil and gravel. The salient point in this is that all of the original material has been utilized in constructing the new mat. The salvage value of the old surface has, therefore, been essentially 100 per cent. This fact is made use of in abandoning sections of previously constructed oil-processed roads, by reclaiming the oiled material on the abandoned sections and using it on the new alignment. Such procedure has been successfully followed in several instances.

Conclusions

After three and one-half years of maintenance experience with oil-processed roads the following conclusions with respect to design may be drawn:

(1) Wide bases, wide surfacing and thickened edges reduce edge failures and minimize maintenance costs; (2) a well-drained subsoil of natural sand or gravel and moderately dry climates are desirable; (3) for stability of mat and the elimination of tendencies to creep and bleed a reasonably dry mix should be used; (4) the type permits increasing to a heavier design with a full salvage of original materials; (5) a thickness of $2\frac{1}{2}$ to 3 in. is adequate for average traffic conditions; (6) thorough blading and processing is essential for best results and smooth-riding surface; (7) aggregates with good mechanical bond produce the more stable mats; (8) complete and thorough drainage is the paramount consideration in the construction and maintenance of oil-processed roads.

Pennsylvania Builds Reservoir for Flood-Control and Park Use

Pymatuning reservoir and state park under construction by day labor as unemployment relief measure—State furnishes camps

FLOOD CONTROL for the Shenango Valley, together with a continual and ample water supply for industrial uses and the establishment of a recreation lake and park, are the combined purposes of the Pymatuning dam and reservoir, now under construction in Pennsylvania by day labor as a state enterprise to relieve the unemployment situation. This project, first authorized by a state law in 1913, was described at the annual meeting of the National Drainage, Flood-Control and Conservation Congress by E. K. Morse, Pittsburgh, engineer member of the Pennsylvania Water and Power Resources Board. From that paper the following particulars are taken. —EDITOR.

THE PYMATUNING swamp, now being converted into a storage reservoir, lies at the head of the Shenango River in Crawford County, in the northwest part of the state on the Pennsylvania-Ohio line, about 40 miles south of Lake Erie. It has an area of 10,400 acres and is about 1,000 ft. above sea level, or 430 ft. above the lake. It is about 80 miles from Pittsburgh and 70 miles from Cleveland.

Steel plants in the Shenango Valley have been hampered by scarcity of water in the summer and fall for 20 years; and this condition has also checked further industrial development in the valley. In the dry season the water is used over and over so often that the river water has been at 140 deg. F. At times it has been used 18 to 20 times in 24 hours by the steel mills. The minimum recorded flow, in 1930, was only 8 sec.-ft., or about 5,000,000 gal. per day, causing the shutdown of several plants. On the other hand, the flood of 1913 caused a loss of $2,000,000 in the cities of New Castle and Sharon and probably $3,000,000 in the entire valley. With completion of the Pymatuning dam and reservoir, there will be a minimum and regulated supply of 400 sec.-ft. or 258,000,000 gal. per day.

The reservoir is L-shaped, 12 miles long, has a maximum width of 2½ miles and will have a water surface of 17,000 acres at El. 1,008, including 2,000 acres in Ohio, which state has passed a law authorizing Pennsylvania to flood that area. About 25,000 acres of land have been purchased, of which 10,000 acres has to be cleared of brush and second-growth timber.

The dam will be a rolled earthfill, about 1,500 ft. long, with a concrete spillway. Its height will be 20 to 50 ft., the bed of the stream being at El. 970 and the crest of the dam at El. 1,020. The state will stock the reservoir with fish and wild fowl and will develop the land bordering the 70 miles of shore line as a state park with convenient highways, including a 2½-mile road across the lake.

Day-Labor Construction — The last state assembly appropriated $1,500,000 for the construction of the dam, but about $1,100,000 has been made available for clearing the wooded land, building highways and changing the grades of railroads that will be submerged. It was the intention of the Water and Power Resources Board to let this work by contract, but at the instance of Governor Pinchot it was decided to have it done as an unemployment relief measure, under the direction of the board, although this method will be more expensive. Tents and commissary equipment were furnished by the state, so that labor can be cared for at the site. Common labor is paid 35c. per hour for a nine-hour day and is furnished food and lodging at cost (85c. per day). There will be two large camps caring for about 600 laborers; about as many more will be employed in certain sections, and where tents are not available the men will go to and from work in trucks. Noon-day meals will be hauled to the men by trucks.

It was hoped that about 1,500 men would be cared for till the end of April. Construction on the dam, highways and railroads will continue throughout the year 1932. The completed reservoir will cost, according to present plans, about $3,000,000.

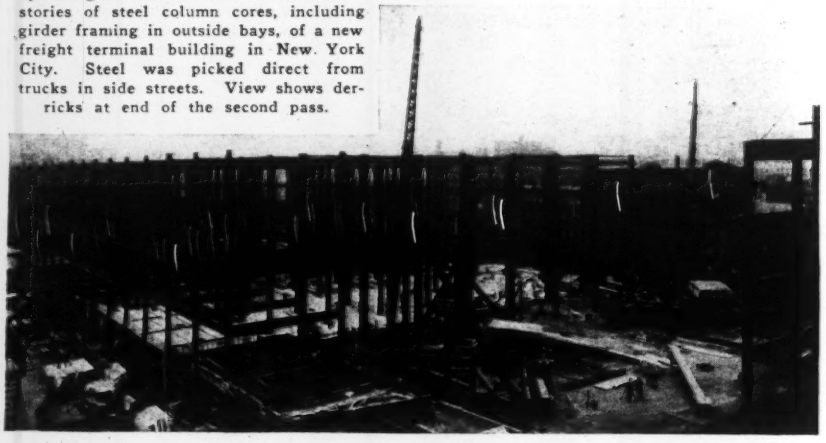
Derrick Travelers Adapted to Steel-Frame Building Erection

Ten stories of steelwork consisting in width of building of two bays of column-and-girder construction and six bays of reinforced-concrete column cores erected in three passes on block-long freight terminal building in New York City

IN ERECTING the steelwork for Inland Terminal No. 1 of the Port of New York Authority in New York City, stiff-leg derrick travelers were used with marked success. Although travelers have been widely utilized in bridge construction, this is believed to be the first time the principle has been adapted to the erection of a large multi-storied building, at least in this country. It was possible to consider travelers for this building because of its large area and the regular layout of the columns. A notable feature of the erection program was that ten stories of steel were erected, with the travelers being jumped only once.

The building, which is sixteen stories high, covers an entire block between 15th and 16th Sts., 8th and 9th Aves., and is 800x206 ft. in plan. Structurally the building is divided into three units, a structural-steel-framing unit seven bays deep at either end, and a reinforced-concrete-framing unit 21 bays long between. The building is eight bays wide. In the reinforced-concrete

Fig. 1—Two stiff-leg traveler derricks operating on the second floor erected six stories of steel column cores, including girder framing in outside bays, of a new freight terminal building in New York City. Steel was picked direct from trucks in side streets. View shows derricks at end of the second pass.



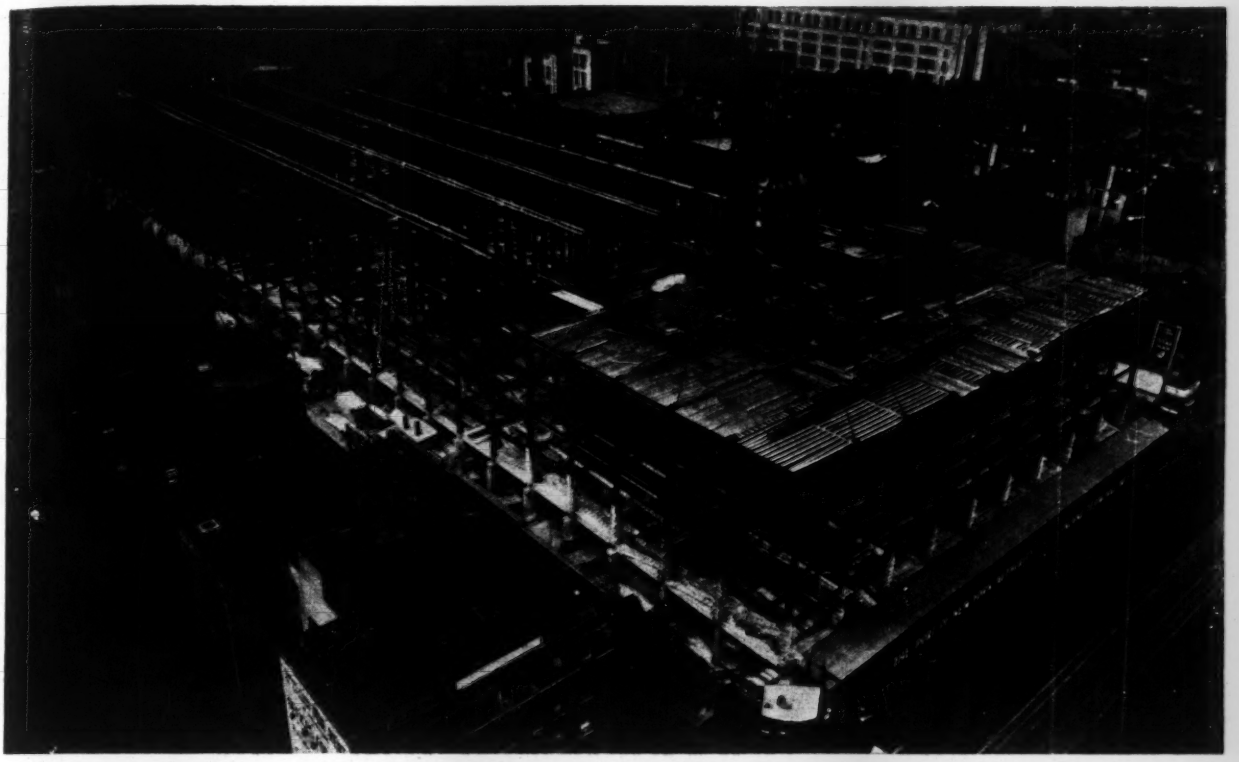


Fig. 2—Travelers are being assembled on sixth-floor level of Port Authority freight terminal building in New York, preparatory to erecting floors 6 to 10. Building is 800x206 ft. in plan dimensions. Structural steel in planked area, which fronts on 8th Ave., was erected by guy derricks.

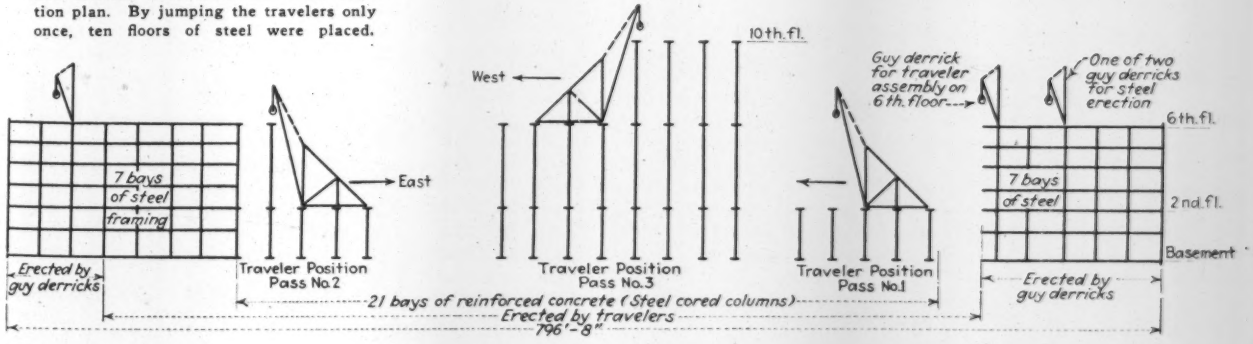
unit the exterior bays along 15th and 16th Sts. are 35 ft. wide, with steel girders between the columns. Inside these bays is flat-slab construction with the columns having structural-steel cores to the tenth-floor level, after which they change to bar reinforcing. In general, the flat-slab panels are about 23 ft. square.

Steel-erection plan

A study of the steel-erection problem, on the basis of using guy derricks, indicated that fourteen derricks would be required if this method were adopted, since the general contractor planned to pour each floor complete from one end of the building to the other, requiring that steel over the entire site be erected simultaneously and continuously. Guy derricks seemed necessary for the two structural-steel units, but further study of the reinforced-concrete unit indicated that it could be erected more economically by two travelers. This procedure therefore was adopted, the travelers taking the place of eight guy derricks, which, with their base supports requiring substantial temporary bracing and anchorage in the unbraced column-core section, would have been extremely difficult to use. The traveler bases, on the other hand, extending two bays transversely and two bays longitudinally, would serve as the necessary bracing. Two guy derricks are being used at either end of the building to erect the structural-steel units, and at the east (Eighth Ave.) end an additional guy derrick was placed on the sixth floor to assemble and jump the travelers.

Study of the traveler-erection scheme indicated that it would work very well in conjunction with the floor-at-a-time pouring method for the concrete, and this belief was substantiated later. The guy derricks on the east end could rapidly erect several floors of steel, giving the concreting gangs a place to work while the travelers were being set up. Then, as the travelers moved westward on the second-floor level, the concreting could follow closely behind. On the return pass of the travelers the completed concrete floor below gave the steel column cores added stability. Another advantageous factor in the use of the traveler-derrick scheme was its conservation of manpower, only four raising gangs being required for the entire job. Two of these gangs manned the guy derricks on the east end of the building, and two operated the travelers. When the travelers completed the erec-

Fig. 3—Schematic diagram of freight terminal building shows how travelers and derricks were combined in the erection plan. By jumping the travelers only once, ten floors of steel were placed.



tion of the steel column cores, their gangs were transferred to guy derricks on the steel-framing unit at the west end of the site, which had been retarded by foundation construction. The two gangs on the east guy derricks were continuously employed, since this section was nearly twice as high as the section to be erected by the travelers.

Traveler design

Each traveler was in reality a steel stiff-leg derrick mounted on three flanged-wheel trucks. The base sills formed a right isosceles triangle with the equal sides two bays, or 46 ft., long. The total weight of each traveler was 48 tons, and a lifting capacity of 25 tons was provided by a 100-hp. electric motor operating a two-drum hoist with

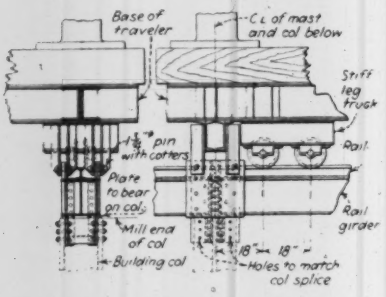


Fig. 4—Travelers operated on girder rails attached to the tops of the building columns by a special detail that was also pinned to the traveler frame to resist uplift.

a speed of 350 ft. per minute on the bare drum 16 in. in diameter. Booms 88 ft. long were used, enabling the travelers to transfer steel directly from trucks in the street to its place in the building.

As an initial operation the structural-steel unit at the east end of the building was carried up about four stories, after which the travelers were assembled on the second-floor framing at the east end of the reinforced-concrete unit. Special girder rails on the second and fourth column lines in from either street supported the traveler wheels and were moved ahead as the travelers advanced. In these positions each traveler was able to cover one-half the site.

Special column-top details, as shown in Fig. 4, were developed for supporting the girder rails and travelers on the steelwork and for anchoring the travelers against uplift. The principal element of these details was a temporary stub built up of plates and angles and spliced to the top of the column cores by bolts. This stub provided a space between side plates into which the girder rails could be inserted. Also the plates were extended above the girder rails and were provided with holes into which pins could be placed, anchoring the travelers to the frame. These anchorages, near the trucks of the traveler, in general provided sufficient resistance against uplift, but when necessary wire-rope slings could be attached to the columns that occurred directly under the center of the stiff-leg sills.

Lateral stability of the steelwork at the travelers was largely provided by the travelers themselves, which spanned two bays. The outer bays were framed with permanent girders, leaving only the two center bays unbraced, and in these bays temporary channel struts were provided opposite the travelers when required.

Traveler operation

Moving westward on the second-floor level, the travelers set the two or three stories of steel between the sub-basement and the second floor, in effect building a platform for themselves as they proceeded. Both columns and girders had to be erected in the two exterior bays, but in the interior bays only the column cores, together with temporary steel angle struts, were required. On the first pass the travelers erected 21 bays in the reinforced-concrete unit and four bays in the steel unit at the west end of the site. The last three bays in this steel unit could not be erected at that time because their foundations were not complete.

On the second pass, moving eastward but still on the second-floor level, the travelers set the steel in the same area between the second and sixth floors. Steel was placed in two-story lengths. Upon the completion of this pass the travelers were dismantled by the special guy derrick set up on the structural-steel unit at the east end, lifted to the sixth-floor level and re-assembled in reverse position. On the third pass, at this sixth-floor level, the travelers, moving backward, erected the steel between the sixth and tenth floors, the limit to which structural steel was used in the reinforced-concrete unit. The job then being complete, the travelers were dismantled. A total of 12,000 tons of structural steel was set by the two travelers in 44 working days.

The traveler-erection method was developed and used by the structural-steel contractor, Taylor-Fichter Steel Construction Co., New York City. The Turner Construction Co., New York, has the general contract for the building.

Brick-on-Metal Base Fails on Illinois Test Road

Detailed report by Illinois division of highways discloses complete inability of flexible metal base to hold brick surface on wet clay-loam sub-base

DESTRUCTION and replacement of the brick pavement on a sheet-metal base constructed in 1930 near Springfield, Ill., are described in detail in a report by the Illinois division of highways, of which Frank T. Sheets is state highway engineer. The construction of this pavement was described in *Engineering News-Record*, Oct. 2, 1930, p. 523. Briefly, the pavement was an experimental section 150 ft. long and 18 ft. wide. Three forms of metal base were used, each for a 50-ft. section, and all are laid on the Illinois black clay loam, shaped and rolled to true profile.

Base structure

The three forms of metal base are shown by the drawings of Fig. 2; two were of 10-gage galvanized corrugated plates laid differently, and one was of ¼-in. flat plate. On the first 50-ft. section the plates were laid with corrugations parallel to the road, six across the pavement, as shown by Fig. 2A. This arrangement gave a joint across the pavement every 10 ft., at which the plate ends were carried on T-beams sunk in the subgrade. The outer side of each outside plate was bent up to form a curb, and one side of each inside plate was bent down to grip the subgrade. In the second 50-ft. section the plates were laid with the corrugations across the road. Fig. 2B shows the details. The T-beam joint was along the center line of the pavement, the lap joints and bent-down edges were across pavement, and the curbs were angles, since the plates could not be bent up across corrugations.

An entirely different plate was used for the third 50-ft. section. These plates were plain ¼-in. steel, 9 ft. 1 in. long and 5¼ ft. wide, and were laid lengthwise, two across the pavement with bent edges, as shown by Fig. 2C.

All plates were spot-welded to each other at laps and joints, so that each section of base was essentially a unit. The bottoms of all plates were given rust-prevention coatings of various kinds. The tops were protected from rust by the sand-tar mastic cushion on which the bricks were laid. The brick surface was laid exactly as for the regular concrete-base brick road in which the metal-base section was built.

Traffic conditions

The test section was opened to traffic Oct. 2, 1930. Normally the traffic is

Fig. 1—Test section of brick pavement on sheet-metal base after completion of test. Pavement at each end is of standard concrete-base construction.

moderately light. To give the pavement an accelerated service test, the highway department arranged for repeated travel over the test section and adjacent standard sections by a 24,000-lb. truckload (16,000 lb. rear and 8,000 lb. front) on solid tires. This truck made 2,185 trips on one side and 2,103 trips on the other. During this travel, cross-sections were regularly taken, and a detailed record of damage was kept. On Sept. 9, 1931, the pavement had been destroyed (Fig. 1) and was ordered replaced.

Test results

Details of damage occurrence are not given here, but the summary from the report follows in abstract.

The various types of base were placed on an extremely hard and dry subgrade. Weather conditions were such that very little outside moisture affected the subgrade during the first eight months. It is believed that conditions during the first eight months were such that the subgrade did not deform a great deal under load. Consequently, the distribution of the load was not an essential factor, and it may be assumed that a relatively small deflection of the metal base occurred. However, when compared to a rigid base, the metal base, even under these conditions, was extremely flexible, and it is quite probable that even at this stage the bituminous filler between the bricks was damaged by the relatively large vertical movements of this pavement. This, however, cannot be determined definitely, since it was difficult to discern failures in the bituminous filler during dry weather.

The rains that occurred during May, 1931, evidently affected the subgrade for the first time, making it less stable and causing greater deflections of the metal base under the wheel loads. Apparently the brick surface was not capable of withstanding the greater deflections without loosening the bituminous filler. The loosening of the filler admitted water through the spaces between the bricks, permitting it to penetrate the mastic cushion. The presence of water apparently lubricated the mastic and caused it to shift, resulting in its accumulation of spots, thereby raising the surface in some places and allowing it to rest directly on the base in others.

The stage at which the base became permanently deformed cannot be determined with accuracy, but it is believed to have occurred simultaneously with the lowering of the stability of the subgrade by rainy weather, since the surface began to show roughness at this time. That permanent deformation of the base increased during the subsequent rains is very apparent.

It appears definite that corrugations placed in the longitudinal direction are more effective than when placed in the transverse direction.

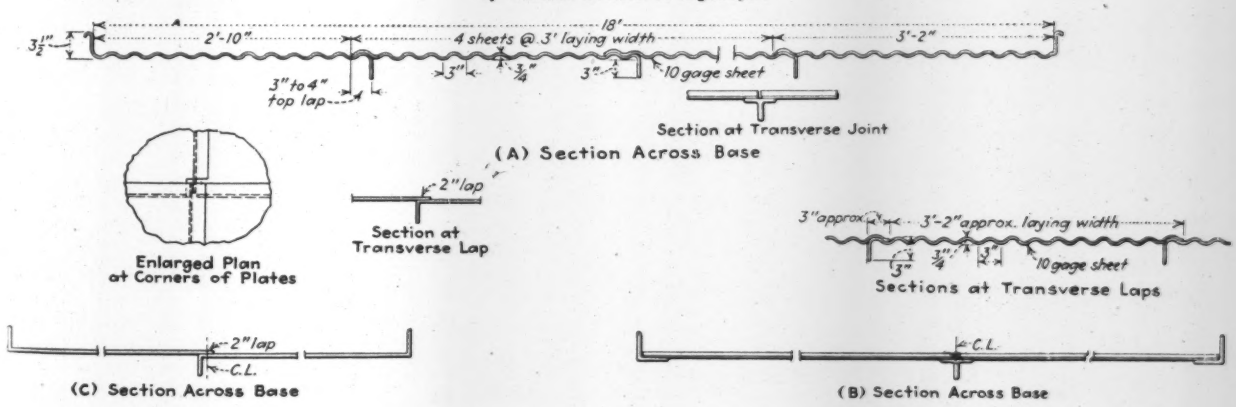
It is problematic, however, whether the 10-gage corrugated sheets in section 1 were superior to the ¼-in. flat plates in section 3. At one point in section 1 a greater permanent deformation of the base occurred than at any place in section 3. Also, some of the corners of the sheets in section 1, where they were joined to the transverse tees in the subgrade, showed a distinct deformation. In other respects the permanent deformations were shallow depressions directly under the path of the wheels. When all details are considered, perhaps the flat steel base in section 3 may be considered as having withstood the test more satisfactorily than the corrugated sheets in section 1.

The reason that section 2 failed to a more serious degree than the other two sections may be attributed to the inferior strength of the corrugated sheets when placed in a transverse direction. The spot-welded curbs for stiffening the edge were not as satisfactory as the integral curbs used in sections 1 and 3. When the welds failed the base was materially weakened and was unable to resist the stresses in the longitudinal direction.

Due to the short length of time involved in the experiment it is impossible to draw any conclusions as to the effectiveness of the corrosion-resisting agents applied to the bottom surface of the various metal sheets.

In summing up it may be said from the results of this experiment that a bituminous-filled brick surface must be

Fig. 2—Details of three forms of metal base for brick pavement tested in 1931 by Illinois division of highways.



constructed on a rigid base. Flexible bases cause loosening of the bituminous filler, thereby admitting surface water and ultimately resulting in the destruction of the mastic cushion. Since permanent deformation of the base occurred in all sections, as well as complete failure of a large part of the base in section 2, it is a difficult matter from the present data to draw definite conclusions in regard to the possibility of designing a metal base which is capable, from a structural standpoint, of carrying the traffic loads that may come upon it and which is at the same time satisfactory from an economical standpoint.

Deep Open-Caisson Foundations for Transmission Towers

Towers 453 ft. high for 4,300-ft. transmission-line span across the Mississippi River founded on caissons sunk 110 ft. below bank level by open excavation

FOUNDATIONS in the alluvial banks of the Mississippi River offer peculiar design problems. The soils are silt, sand and clay deposited by the river in layers, lenses and pockets to such depths that they put out of consideration any possibility of seeking other more solid foundation beds. All the soils are highly erodible, and the river between levees is at any time likely to swing into the bank and carry it away, laying bare to channel depth any foundation structure. The design of a foundation therefore involves the usual problems of safe bearing power of soils and the unusual problem of insuring strength and stability in case lateral support is removed to a great depth by erosion and the uncovered structure is subjected to the thrust of swift impinging currents. These are the problems taken into account in the foundation work described in the following article. The work is also notable for the exceptional depths to which small-diameter caissons were sunk by open excavation. —EDITOR.

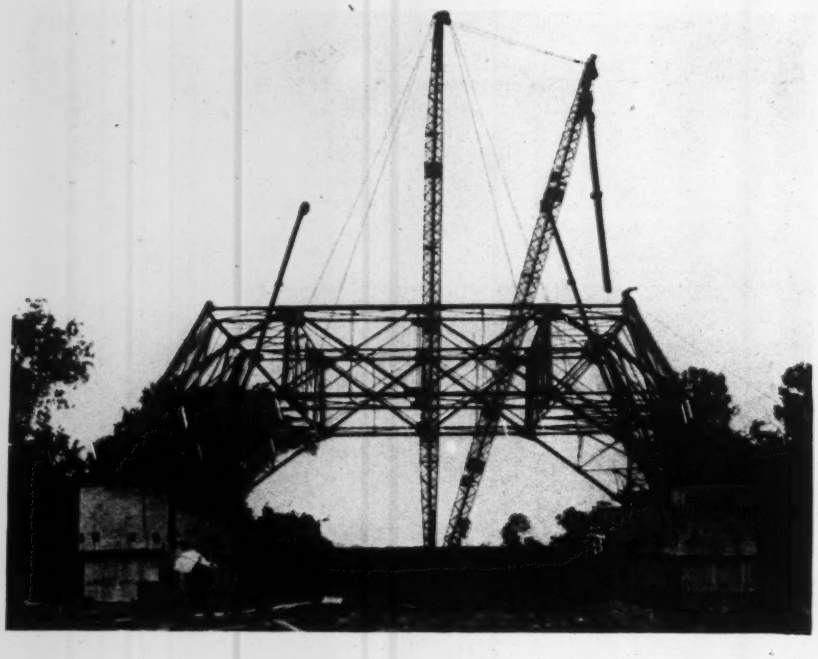
THE FOUR-CYLINDER foundations for the towers of a transmission-line crossing of the Mississippi River, recently constructed about 8 miles below Memphis, Tenn., are designed on the hypothesis that scour may remove the ground to a depth of 75 ft. below present bank level. With the present projection of the cylinders 18 ft. above bank level, such a depth of scour would leave 83 ft. of unsupported shaft, of which 75 ft. would be subjected to currents up to 6 miles an hour. To meet this requirement, the foundations were sunk 110 ft. below bank level, or 35 ft. below present river bottom, which is assumed as the limiting depth of scour.

Crossing structure

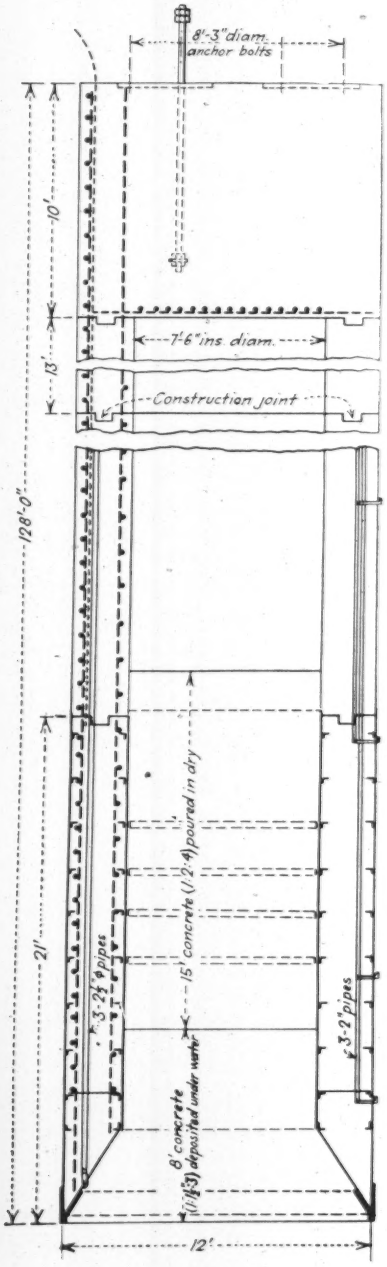
The new crossing provides a double-circuit high-voltage interconnection between the Arkansas Power and Light Co. and the Memphis Power and Light Co. At the crossing the river is [illegible] ft. wide at bankfull stage, with [illegible] water extending ¼ mile west to the Arkansas levee and about 5 miles [illegible] to high ground on the Tennessee [illegible]. The tower foundations therefore [illegible] within the high-water area. In fact, each is located about 350 ft. inshore from the river bank.

Quite the usual design of crossing was adopted. The span across the river between towers is 4,300 ft. Each shore span from main tower to the end towers, or dead-end posts, is 1,800 ft.

Concrete cylinder foundations for transmission-line towers, showing lower part of tower framing arranged to provide portal bracing between cylinders.



Vertical section of one of the four foundation caissons for each 435-ft. steel tower for a 4,300-ft.-span transmission-line crossing of the Mississippi River.



The main towers are 453 ft. high, of which 435 ft. is steelwork and 18 ft. is the extension above bank level of the foundation cylinders. The dead-end posts are steel A-frames 45 ft. high. They stand on concrete footings and are guyed from their tops to concrete anchors. There are four dead-end posts, one for each conductor.

Each main-tower foundation is made up of four cylinders, each reinforced-concrete caisson 12 ft. in diameter, with a 2¼-ft. shell, sunk to 110 ft. below bank level and extending about 8 ft. above this level. Each caisson is filled with concrete for 23 ft. at the bottom and is capped with a reinforced block 10 ft. high and 12⅝ ft. in diameter. The total height of each foundation cylinder is therefore 128 ft. As stated, they are designed to meet the contingency that the bank may scour down to present river-bottom level. If this happens, the four cylinders will carry a vertical load of 170 tons safely, a horizontal shear at the top of 16 tons and the pressure of a current of 6 miles an hour.

Caisson sinking

The caissons were sunk by excavating inside the shell, with the weight of the concrete, aided by jetting, providing the necessary sinking force. A hole about 20 ft. deep was dug with a clamshell. On the bottom a double-shell steel cylinder was set and leveled. This cylinder had a reinforced cutting edge at the bottom, and the wall space between shells (after the cylinder had been centered and leveled) was filled with concrete. Excavation inside was then begun with the clamshell. As the caisson sank, successive 12-ft. sections of reinforced-concrete shell were added at the top. These were poured in wood forms with steel lining. Jet pipes 3½ and 2 in. in diameter were built in as each section was concreted. These connected with jetting nozzles at about 10-ft. intervals near the bottom of the caisson. No great difficulty was experienced in keeping the alignment; all caissons were within 1 ft. of true center at the top. Any eccentricity was corrected in placing the caps. An interesting feature of the design is that the cylinders were not tied together by concrete portals. Instead, the first section of steel above the caps forms a complete portal. While this called for heavier steelwork than usual, it proved to be more economical than concrete.

General Contractors Propose Construction-Revival Program

Executive board at spring meeting adopts formal program calling for a federally financed reconstruction corporation

A CONCERTED drive for enactment by Congress of legislation deemed necessary to remedy some of the present ills of the construction industry was made at the spring meeting in Washington on May 2 and 3 of the executive board of the Associated Geenral Contractors. Accepting the action of the policy committee of the Construction League, which met the previous week, the association promulgated a program for reviving construction, which called for federal organization and financing of a reconstruction corporation.

Construction program

Summarized briefly, the proposed program is as follows:

1. That the federal government, through an act of Congress, immediately create a productive reconstruction-work corporation.

2. That this corporation be provided with $1,500,000,000 of capital through issuance of bonds of the United States.

3. That this corporation be empowered to make loans at cost to states, cities and other public agencies to finance self-supporting and self-amortizing public improvements.

4. That preference shall be given by the corporation in making loans to projects involving: the rehabilitation of slums and the creation of better housing facilities; the construction of sanitary improvements; the modernization of obsolete public utility plants; and the improvement of public transportation facilities.

5. That all loans made shall be on the basis of self-determination, shall be properly secured and shall contain provisions for the regular payment of interest and amortization charges.

6. That the funds of the productive reconstruction-work corporation shall constitute a revolving fund to be used during the existence of the world-wide depression.

In approving this specific plan and program the Associated General Contractors continues its approval of other similar measures that conform to it in principle. It disapproves of proposals for direct doles or subsidies even in the face of present conditions that are driving large sections of the population to despair. It maintains that, through the launching of constructive works and the furnishing of employment, not only can relief from those conditions be afforded but the development of the national wealth will repay the cost of the outlay.

Legislation approved

Foremost among the current legislative measures urged were the federal home-loan discount bank bill, the Metcalf bill for the extension of prevailing wage legislation to all classes of public construction, with a provision that the wage shall be predetermined; the Cochran bill for the creation of an administration of public works; the Blaine-Christopherson bill for uniform requirements in all government construction contractors; the emergency federal-aid highway bill for the relief of unemployment; and the bill requiring the employment of local architects on government work. The board also indorsed the retroactive repeal of the recapture clause of the transportation act, which its railroad contact committee believed is seriously hampering the development of the railroad facilities of the country.

Safety platform adopted

The following safety platform was adopted as approved by the cabinet of the association:

1. That manuals of safety regulations be prepared and revised by and for the industry in lieu of laws and legalized codes.

2. That it is the business first of every industry to support the American safety movement and to provide adequate safety programs that save personnel, pay dividends and insure profits.

3. That general contractors continually conduct their field operations in accordance with well-recognized standards of safe practices for protection of employees and the public.

4. That subcontractors in their shops and on their field work abide by standard practices for safety of their own and other employees.

5. That craftsmen and their helpers realize that safety rules are for their protection, that everlasting vigilance minimizes hazards, and that safety first and self-preservation are synonymous.

6. That the National Safety Council serve as the central safety group to evolve adequate technique, proper procedure and psychological publicity.

7. That the Underwriters Bureau, through a national construction department, provide consistent insurance classifications and furnish joint local safety engineers for supervising construction-field operations.

8. That job safety committees be selected regularly to inspect safety appliances and recommend safe precautions and assist in first-aid measures.

9. That all elements of the industry, through their national and local organizations, jointly cooperate through periodical safety meetings to minimize accidents severally and jointly.

A.W.W.A. Program Stresses Safety and Economy

Waterworks improvements advocated at Memphis convention to meet normal requirements and as a business stimulant—Sixty-eight manufacturers display equipment

Engineering News-Record Staff Report

A LIGHTER attendance than usual marked the fifty-second annual convention of the American Water Works Assocation last week at Memphis, Tenn. Registrations totaled only 700, in contrast with last year's 1,000 or more. The program sessions stressing safety and economy in water-system operation were well attended but did not move as briskly and smoothly as they did at Pittsburgh last year. George W. Pracy, superintendent of the San Francisco water department, was elected president, succeeding Ross L. Dobbin, of Peterborough, Ont. W. W. Brush continues in office as treasurer. The 1933 convention is to be held in Chicago.

Medal awards

The Diven memorial medal, presented each year to the member who has been most active in behalf of the association, was given to W. W. Brush, of New York. In selecting him as the recipient the committee chose to waive the rule making an officer of the association ineligible for the award. The award recognized his efforts in studying the economic status of waterworks employees and the relation of municipal water department employees to the payment of federal income taxes.

In recognition of his pioneer work in developing the use of activated carbon in treating water, John R. Baylis, of Chicago, was presented with the John M. Goodell award. This is the first presentation to be made of this prize, which was established last year by *Engineering News-Record*. It is to be given annually to the member presenting the best paper on a research topic that is published in the *Journal* of the association during that year. The award committee felt that the experiments on activated carbon in water treatment conducted by Mr. Baylis had constituted the greatest accomplishment in water purification in the past decade. There are between 150 and 200 water plants in this country and Canada now using the material for the removal of objectionable tastes and odors.

The assets of the association showed an increase during the year of $1,775. However, the membership showed a net decline, 236 members being added and 340 being lost. Total dues collected during 1931 were $2,500 less than the preceding year. For 1932 the association's budget is $69,750, about the same as the recorded expenditures of 1931.

New construction urged

During the past year the committee on immediate waterworks betterments has been most active. A survey of the country's waterworks showed that needed improvements and extensions of existing supplies, including those necessary to make up for the recent lag in normal construction and those required to raise the standard of service to a uniformly satisfactroy degree, would require an expenditure of $550,000,000. The committee has been advocating the undertaking of such a program of waterworks construction and has studied several methods of financing it. At first it was hoped that federal aid could be extended to the municipalities to make the work possible, but little encouragement was received from Congress. Efforts to interest private bankers in the program have failed. A resolution, prepared by the committee and adopted by the convention, calls attention to the dangers involved in the crippling of community water service and the advantages of a construction program in providing work for the unemployed. It urges the national government to adopt prompt and effective action to assure adequate credit at reasonable rates to waterworks systems, so that current construction can be revived, adequate service maintained and desirable improvements undertaken.

Two other resolutions, prompted by the current efforts to reduce federal expenditures, were adopted by the association and called to the attention of Congress. One urges the continuance of the federal appropriation hitherto made each year to provide for cooperative work with the states in assembling streamflow data, under the direction of the U. S. Geological Survey. The second resolution favors the continuance of the cooperative appropriation for public health administration.

Prize exhibits of equipment

Manufacturers' exhibits drew a great amount of attention. There were 68 displays of waterworks equipment. The Wallace and Tiernan Co. display was voted the most instructive exhibit by the active members present and was awarded a silver plaque by the Water Works Manufacturers' Association. Second and third prizes went to [illegible] & Bowler, Inc., and the Dorr Co., [illegible], respectively.

Charles H. Becker, of R. D. [illegible] & Co., was elected president of the Water Works Manufacturers' Association, with W. J. Orchard, vice-president. Edgar J. Buttenheim and John A. Kienle were re-elected treasurer and secretary, respectively.

Broad scope of program

The finer considerations now necessary to assure the safe and economical operation of a water-supply system assumed an important place in the program. Discussions on this subject ranged from the potential dangers to sanitary quality presented by poorly designed plumbing fixtures to the proper financial administration of a waterworks system. The major hazards to community health presented by polluted water have been well overcome in the past few decades, but the increasing discrimination of water consumers against other objectionable features of the supply have led to intensive development in more recent years of newer processes to eliminate undesirable mineralization and objectionable tastes and odors. At the sessions of the purification division of the association many of these newer processes were re-examined and experiences with their applications were brought up to date.

The cross-connection evil

Many minor factors in water quality still remain to present potential health hazards, according to Paul Hansen, consulting engineer, Chicago. One of these hazards, which appears to be perennial, is that of cross-connections between the distribution system carrying a purified supply and that of a private unsafe supply primarily used for extra fire protection. This question first assumed great importance in 1903 when a typhoid epidemic visited Lowell, Mass., as a result of a backflow of polluted water into the municipal supply system. Since then other epidemics from the same cause have occurred, and a constant war has been waged to eliminate such potential dangers or to provide adequate safeguards against them. Other points of possible entrance of pollution are: defective masonry walls of filtered-water conduits or basins, poorly constructed well tops, open reservoirs or standpipes, and drains or blow-offs directly connected to sewers. In addition to the common type of pollution by pathogenic organisms, recent experiences suggest the possible presence at times of intestinal irritants of a more purely chemical nature, causing illness to the users of the water, although bacterial analyses show the water to be safe. It is even possible for direct poisoning of the water to result from improper water connections in serving industries using cyanide or arsenic in their processes.

Now that the more fiagrant type of cross-connection is disappearing, a newer kind is showing up, represented by poorly designed or improperly installed plumbing fixtures. Many cases were cited by S. B. Morris, chief engineer, Pasadena, Calif., water department, where a drop in pressure on the water system was followed by the siphonage of gross pollution back into the service piping and distribution mains. In particular is this true with flushometer toilet valves, which depend upon the pressure in the line to keep the inlet valve closed. Tests were conducted in Pasadena to determine if these valves would be likely to open under conditions of partial vacuum in the supply line. All types of flushometer valves tested were found to be subject to opening under these conditions. It was also found that a 5-in. vacuum would be maintained for one hour in the system if drained of water without air venting This time factor was considered of greatest importance in the discussion that followed the presentation of the paper, as the longer a potential danger persists the more serious it becomes. Connections to special equipment used in connection with polluting materials, such as hospital waste sinks, are hazardous to water quality if improperly installed. Faucets discharging at a point lower than the overflow level of the equipment are constantly in danger of allowing back-siphonage if line pressure should fail.

Other pollution hazards

The disastrous experiences of the Greenville, Miss., water plant during the 1927 flood were described by F. E. Hall. The city was largely inundated at that time, and the waterworks was submerged 6 ft. A sandbag levee was hastily thrown up around the plant, and after the water had been pumped out the equipment was put into condition and started up again. In the meanwhile, two private industrial wells on higher ground had been pressed into service and used to supply the distribution system. Gross pollution had entered the system during the time service had been discontinued, however, and all drinking water had to be boiled for safety for a period of months. In their haste to escape the approaching floodwaters, many householders had neglected to shut off their plumbing fixtures after drawing a supply of drinking water. Boats floating over the flooded streets had broken off many fire hydrants. The lack of a map of the distribution system made valve shut-offs virtually impossible under the flooded conditions. Many changes have been made in the system since that time to prevent the recurrence of such experiences. The new features are designed to allow operation even under severe flood conditions and to assure a constant pressure on the system to prevent the entrance of pollution.

Another pollution hazard arises during the construction of new mains. W. W. Brush described the practices used in New York City in the care and treatment of new mains during the construction period and the methods employed to sterilize them after laying is completed. An important factor is the time interval between the delivery of the pipe to the job and its installation in the system. Dirt and mud inside the pipe should be carefully avoided, as subsequent sterilization will not be effective othewise. In congested districts the pipe should be laid immediately upon delivery. Pipe joints are painted with a strong chlorine solution, and a small quantity of calcium hypochlorite is deposited in each length as laid. The line is filled with water after completion and time is allowed for the sterilizing chemical to act. Similar precautions are observed in repair work. A continuous chlorination method was used in sterilizing the new Wanaque Aqueduct in New Jersey, as described by R. S. Weston. In that case a strong solution of chlorine gas was allowed to flow through the 20-mile steel pipe, taking more than five days for the journey.

Pipe-line materials

During the past few years new pipe materials have come into use, whose life, cost of installation or effect upon the water have an important bearing upon the economical distribution of satisfactory water. For service pipes, copper has been claiming a great deal of attention of late. The cost of installation is somewhat less than lead but greater than that for steel. The material to be used for service connections, according to Geo. W. Pracy, superintendent, San Francisco water department, who discussed the subject before a meeting of superintendents, depends to a great degree on the composition of the soil. In San Francisco most of the ground in which the pipes are laid is of a light sandy character through which a steel pipe can easily be driven. Under prevailing conditions in that city, where paving is usually laid ahead of the service lines, the practice is to excavate only small openings and drive steel service lines through the intervening soil. Because of the absence of frost danger only 2-ft. cover is usually provided. Where piping cannot be driven, copper is used and the trench opened the full length. Brittleness in copper tubing was discussed thoroughly from the floor. Several experiences were cited that suggested improper handling of the tubing by the construction forces as a cause for embrittlement.

The use of plain-end pipes joined with couplings was discussed by T. J. Skinker, of St. Louis. On large cast-iron pipe lines its simplicity is a great asset. For small sizes and low pressures, cement joints were recommended. For pressures above 25 lb. and for large sizes mechanical joints were favored by Mr. Skinker. Joints made with cast lead or lead wool were found to be difficult to make tight.

Cement linings for cast-iron pipe have been developed in an effort to prevent tuberculation, which cuts down capacity. According to D. B. Stokes and H. G. Reddick (U. S. Pipe and Foundry Co.), who presented a paper on linings, tuberculation will not occur unless the iron of the pipe is exposed at some point, however small. It has been found that hardness is increased when water passes through cement-lined pipe, and this was attributed at first to the solution of the free lime in the cement. Additional causes must be in operation, however, for tests made with special cement lining containing no free lime showed an increasing hardness also. With large pipe, difficulties are encountered in preparing a lining that will not crack or loosen. Where pipe is exposed it absorbs heat from the sun's rays, and the differential expansion between iron and cement is enough to cause cracking. The major troubles, in fact, with cement-lined pipe have been during hot weather while the pipe was either in storage or in transit. Varying temperatures also cause difficulties with bituminous linings. For best results such pipe should be laid as soon after dipping as possible. A pitch-base lining is now in process of development, which can be applied centrifugally. A placticizing agent is used so that the material will maintain its placticity within a wide range of temperatures. Further experiences with cement-lined pipe were related by E. O. Sweet, of Birmingham, Ala.

Waterworks equipment

In the field of waterworks equipment manufacturers are continually striving to improve efficiencies and durability of their producs, and engineers are striving to perfect their knowledge in the proper application of them. Deep-well turbine pumps and the characteristics of the various types were treated at length in a paper by David J. Conant, of Layne & Bowler, Inc. Successful applications of turbine pumps have been made in wells as deep as 825 ft. The three major types—impulse, reaction and mixed-flow—have distinct characteristics and fields of usefulness. The impulse pump, like the impulse turbine, is usually of high head and low capacity. Few of them are on the American market. The reaction and the mixed-flow types are both available, with the latter the more recent development. The mixed-flow turbine presents a difficult foundry problem, but because of its flat characteristic curve is well suited to wells in which the water level varies widely. It is a high-capacity pump and approaches the screw pump in its performance.

New developments in filter-plant control equipment were described by C. G. Richardson, Builders Iron Foundry. At the new Albany, N. Y., filter plant it was necessary to control the flow in the long influent conduit, so that there would be a constant level of water on

the filters without causing a widely varying flow in the conduit. At Ottawa, Ont., an indicating and recording device was developed for the pressure in the washwater line and incorporated with the gages on the filter-operating tables. At New Haven, Conn., in connection with a sewage plant, control equipment was devised that allows a flow of 40 m.g.d. to enter the treatment plant, but all excess is diverted to the river.

Water revenues

Chicago's waterworks revenue was increased $583,000 over a six-year period by a careful adjustment of meter sizes to the legitimate needs of the consumers, according to Loran D. Gayton, city engineer. Although most of the domestic services are unmetered, revenue derived from metered accounts represents a large share of the total income. For this reason accurate registration is highly important. For the past six years a survey has been made of the larger and older meters, using an auxiliary device that fits over the existing meter and prints a record of the rates of flow registered at all hours of the day and night. Whenever the record discloses very low flows extending for any length of time, the meter is replaced with one of a smaller size. Recorded consumption has been steadily increased as a result of this work, and the additional revenue is nearly three times as great as the cost of conducting the survey.

The subject of increasing water revenues without raising rates was treated in a more general manner by E. E. Bankson, of the J. N. Chester organization, Pittsburgh. Not only by adjusting meter sizes more accurately to the class of service required can this end be obtained, but also by attempting to find new classes of consumers. Sometimes a readjustment of the rate structure, giving lower rates to industrial users, will result in greater total revenues because of a number of new customers. Greater economies in operation also will have the effect of raising net revenue.

V. Bernard Siems (National Water Works Corp., New York), in a paper on the subject of construction reserves in water-utility operations, advocated the setting aside each year of sufficient funds to enable the management to carry out its program of improvements and betterments in times of depression when revenues are low. Such improvement reserves were held to be of benefit in leveling the financial peaks and valleys in waterworks operaiton. Such a procedure would probably require a modification in the laws regulating utilities in the case of privately owned systems.

Construction costs in the waterworks field are at a very low point at the present time. W. W. Brush gave the pertinent data regarding the course that price levels have taken in the past 30 years, with special attention to the prices of those items entering into waterworks construction or operation. Mr. Brush advocated that the association undertake through a committee to set up an agency whereby such costs at many points over the country could be ascertained continuously.

Judicial opinions have slowly been defining valuation methods in public utility regulation, according to L. R. Howson, consulting engineer, Chicago, who discussed the recent trends in factors affecting the rate base. Such factors as accrued depreciation in determining rate base and annual depreciation in computing operating charges should be based on present reproduction costs rather than original investment, the courts have held. Intangibles like going-value and good-will, although difficult to compute, can be based on the same engineering principles as other appraisal methods.

However valuable a waterworks system is in affording fire protection to a community there are other important considerations in determining the fire hazard in any city, said George W. Booth in explaining how the National Board of Fire Underwriters computes the classification of a city. The underwriters' grading schedule assigns to water-supply considerations 34 per cent of the total number of items entering into the final grade. Other factors include the fire department efficiency, the fire-alarm system, materials used in building construction and the control exercised over the use of hazardous materials and processes in industry. As a result of the decreasing fire hazard the average premium for fire insurance has been reduced from $1.08 per $100 in 1910 to 77c. per $100 at present.

Local problems

Memphis has the largest single water system in the country deriving its supply entirely from groundwater. It is advantageously located for that purpose, for great deposits of water-bearing sands underlie the city, outcropping in extensive gathering grounds 70 miles or more to the east. The bedrock beneath the sands dips gradually toward the south, from Cairo, Ill., to the Gulf of Mexico, and in the east-west section is bowl-shaped, with Memphis in the center. The head on the groundwater is sufficient to cause wells west of the Mississippi River to overflow freely, but because of the higher ground at Memphis considerable pumping is necessary. The methods of constructing and maintaining deep wells in such material were described by Thomas H. Allen, consulting engineer, Memphis, in a paper prepared jointly with W. G. Lanham, of the Memphis water department. F. G. Cunningham and Wellington Donaldson, of the Fuller & McClintock organization, described the pumping and purification plant of the Memphis waterworks.

The 34 Memphis wells now supply 19 m.g.d. to a city of 250,000. Because of the abundance of underground water there are numerous private supplies being used by industries and commercial houses. The static level of water in the wells averages 50 ft. below ground at the Parkway Station, and air lift pumps are used to bring it to the surface. The CO_2 content of the water in the strata most fully developed is high (120 p.p.m.), and aeration is necessary to remove it and the iron salts carried in solution. The air-lift process effects considerable removal of the carbon dioxide and oxidation of the iron salts, but secondary aeration is required before the flocculated iron can be filtered out. Coke-tray aerators are used in this second step. A second waterworks plant is now being developed, in following out the plans made some years ago. It is far enough away from the present development so as not to interfere with the drawdown, but in all essentials it will be its counterpart in design.

Los Angeles was the other city to have its water-supply system discussed. W. W. Hurlbut, water-distribution engineer of the city, related the various efforts made to expand the supply of that city to keep pace with its rapid growth. Of great importance in the Los Angeles region is the large amount of underground storage available. A large part of the present city, in the southern portion of the San Fernando valley, demands a great deal of water for irrigation purposes. Much of the water supplied for that use finds its way into the underlying gravels and either reappears as surface flow in the Los Angeles River or is pumped to the surface through the water system's auxiliary well developments. These wells are used to provide additional supply at times of high demand, their production being pumped directly into the distribution system, having an effect similar to that of elevated storage. In addition to the three existing sources of water—the Los Angeles River, the Owens valley supply and the local wells—the aqueduct projected to bring water from the Colorado River is scheduled for completion in 1940. The Colorado River aqueduct was discussed at last year's convention by Julian Hinds.

The general subject of diversion of water from one drainage basin to another was given full discussion in a paper by Robert E. Horton, consulting egineer, Voorheesville, N. Y. The paper was presented to the convention in abstract by Abel Wolman. Mr. Horton's treatment of the subject was quite comprehensive and dealt with the legal phases of diversion as well as the engineering phases. One principle enunciated is that to allow water to run to the sea without being put to any use at all is a waste. In discussing the question of conflicting claims to the use of the water as it flows in its course, Mr. Horton confined his attention to the usage in the eastern part of the country,

based upon riparian law. It was strongly advocated that a program be set up for the country's important streams, allocating to the various uses of the water a share of the flow consistant with the importance of the interest involved. Such a plan should be based upon a study of the probable future growth of population and consequent demands for domestic water supply, for water power, navigation and other legitimate uses for the river's flow.

Water purification

Within the past few years the practice has grown of looking to more intense filter washing to keep the sand bed clean and to avoid the ills attendant upon dirty sand. For three years the Baldwin filtration plant at Cleveland, Ohio, has been operating its filters so that the rate of application of washwater is varied in accordance with water temperature, involving higher rates of wash in the warm-weather months. The first year's operation, as reported at that time by W. C. Lawrence, superintendent of the plant, gave promise of great improvement in operating conditions. Mr. Lawrence presented to this convention his more recent observations and concluded that the new washing technique had fulfilled all its promises. In contrasting the operating records of the past three years with those of the preceding three years it is found that washwater consumption has been decreased one-third, filter runs lengthened two-thirds and bacterial efficiencies somewhat improved. The technique employed in washing is to adjust the rate of application to produce an expansion of 50 per cent of the sand depth at all seasons of the year. In addition, once every two weeks, one-fourth of the filters are taken out of service, drained and raked over. Any organic matter that may have accumulated is loosened sufficiently to be removed easily by the first subsequent wash. The sand in the plant is in good condition, is free from organic matter and has the same color as it did originally.

Further experimental work on filter sand is being fostered by a committee working under the purification division. Original research is now under way at three places—Harvard University, Detroit and Chicago—in addition to the list of cities carrying out cooperative experiments under the direction of a committee of the American Society of Civil Engineers. The work at Harvard and at Detroit is primarily of a pure hydraulic nature, seeking the physical laws governing the loss of head occasioned by the sand bed under various conditions of size, packing and water temperature.

Manganese troubles

In addition to the filter troubles caused by an accumulation of coagulum on the sand grains, water bearing manganese salts in solution frequently cause difficult filter-maintenance problems. Such waters are frequently associated with bituminous coal-mining regions. Streams into which acid mine drainage discharges almost invariably show a high manganese content. It is not likely that the drainage itself carries the manganese, for, as was described by Perkins Boynton, chemist of the Clarksburg, W. Va., water board, the drippings from mines, the coal itself and acid-free surface drainage are found to contain only traces of it. More likely, there is a bacterial action that produces the salts, and the organisms find acid drainage favorable to their growth. It was found by laboratory tests, that sterilization by heat greatly inhibited the formation of soluble manganese sales. When manganese is present in the water being filtered there is a grave danger of it being deposited on the sand grains, causing the bed to cake and form mud balls. The sand can be cleaned by dilute acid or by a solution of sulphur dioxide.

Further, manganese causes trouble to the consumer. Just as iron in solution is likely to cause "red water," manganese will cause "black water." The greatest victims are laundries, which experience severe staining of clothes when using the water. A paper was read before the convention describing the use of lime and alum to precipitate iron and manganese before filtration. The main function of the lime is to raise the pH of the water, as manganese will not precipitate at a pH less than 9. The process has been used at the Providence waterworks plant with a great deal of success. If copperas is used in place of alum as the coagulant, in conjunction with lime, the removal of manganese is even more complete.

Aeration

In conjunction with iron removal, aeration is of great value. The many improvements the process effects in water quality make it one of the most valuable treatment methods in use. Frank E. Hale, director, Mt. Prospect Laboratory, Brooklyn, presented a comprehensive discussion of the subject, analyzing the various purposes to be achieved, the methods of aeration employed and the chemical and physical actions involved. As a treatment for tastes and odors it is efficacious in the case of decomposition odors and those due to the presence of micro-organisms, but it has little effect on odors due to trade wastes.

Medicinal odors are best dealt with by activated carbon, a material relatively new in water treatment but one that is already of proved value. George R. Spaulding, Hackensack Water Co., reviewed the experiences recorded in using it during the past few years and came to the conclusion that it was to be considered of utmost importance in coping with difficult odor problems. The water at Saginaw, Mich., polluted at the source of supply by chlorophenols discharged by a chemical plant has been rendered entirely satisfactory by the use of carbon, according to Alfred Eckert, superintendent of filtration. It was used at Louisville during the 1930 drought and greatly improved the quality of the water.

Mixing basins

What is most frequently called mixing in water purification really consists of two distinct stages. The first stage consists of dissolving the coagulant in the body of water to be treated and results almost instantaneously in a colloidal hydrate of aluminum or iron, depending on the chemical used. The second stage is one of flocculation, in which this colloid is transformed into a number of floc particles. All this was explained by George E. Willcomb, Albany, N. Y., who proposed the name "conditioning" to describe the combination of the two processes. The amount of coagulating chemical required to produce good fluocculation varies with the pH of the water, its temperature, the turbidity and the intensity and duration of the agitation accompanying the second stage. With turbid water Mr. Willcomb recommended a duration of conditioning of not less than 30 min. and stated that an appreciable amount of coagulant could be saved in that case.

Sedimentation

The great need for improvement in the design of sedimentation basins was recognized in a paper by Arthur B. Morrill, of Detroit. Experimental work on sedimentation is not plentiful, probably because of the inherent difficulties involved. Mr. Morrill gave a thorough discussion of uniformity of flow through a basin and suggested a quantitative index for expressing a basin's efficiency in this regard. The "index of dispersion" suggested is the time necessary for 90 per cent of the water to pass through the basin divided by the time taken by 10 per cent of the water to pass through. Perfection in this regard would be represented by an index of 1. It could be determined by a salt-solution flow test of the basin in question.

In addition to uniformity of flow, there are many other factors affecting the efficiency of sedimentation. The relative importance of surface area and total volume is still debatable, but it is believed that the character of the sediment dealt with in coagulation basins is such that volume, or displacement time, is more important. Surface area would be the criterion of basin value were the settling material of a granular nature experiencing no acceleration during subsidence.

Particular attention should be paid to inlet and outlet devices and to internal arrangements to attain minimum dispersion. "Round-the-end" baffles are objectionable and unnecessary.

From Job and Office

Erecting a Statue on a Building
Tank Roof Raised on Pontoons
Concreting a Lakefront Wall
Gas in Boston Tunnel

Designing Concrete Mechanically
Cranes as Cableway Excavators
Portable X-Ray Apparatus
Spraying Road Metal

Placing 1½-Ton Statue on a Tall Building

By J. D. Levin
Babb, Mont.

SETTING a 16-ft. 3,000-lb. bronze statue of the "Spirit of Progress" on a tower 200 ft. above the street was an undertaking for the erection crew on the administration building of Montgomery Ward & Co., Chicago, the construction of which was described in *Engineering News-Record* of April 10, 1930, p. 619. The placing of this statue on the tower is shown in Fig. 2 and the hoisting rig in Fig. 1.

An 8x8-in. fir post 22 ft. long, seated on a window sill of the tower, was used to set the statue in place. The base of the pole was set in a kicker box made of 4x4-in. stock, which was anchored to the concrete pedestal by several strands of No. 9 wire twisted together, the whole being shored up to carry the thrust directly to the structural slab below. As suitable anchorage for guys was lacking on the north, east and south sides of the tower, outriggers made by spiking together three 2x10-in. planks were run out of the windows on the story below, and the ¾-in. wire-rope guys were secured to the outer ends. These outriggers, or lookouts, were well braced against overturning by 6x6-in. shores within the tower. A ¾-in. wire-rope guy fastened to the west parapet wall served as a back line.

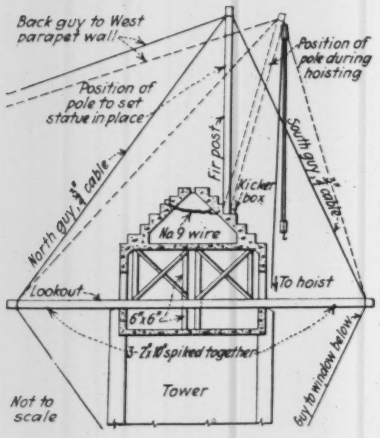


Fig. 1—Rig for hoisting statue.

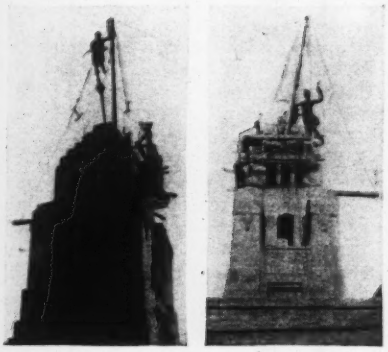


Fig. 2—Hoisting statue to top of tower.

Several turns of 1-in. manila rope were wound around the statue slightly above its center of gravity, and to these the hoisting block was attached. An electric hoist, rated at 2-ton capacity, with ¾-in. wire-rope tackle, served the purpose. The pole was hung out far enough to clear obstructions as the statute was pulled up the side of the building and was then pulled upright to allow the statue to be placed in position. A temporary wood scaffold on the south and west sides of the tower provided working space for the erectors.

The statue is posed on an 18-in. ball-shaped pedestal, and resistance to wind pressure is provided by a star column, made of four 4x4x¼-in. angles, which extends from the groin of the statue, through the leg and 8 ft. into the tower. Additional anchorage is provided by several ½-in. steel reinforcing rods hooked into the bronze pedestal and embedded in the concrete base.

This statue was made by G. Mulligan, sculptor, Chicago. The building design was under the supervision of W. H. McCaully, construction engineer for Montgomery Ward & Co. The general contractor was the Wells Brothers Construction Co., with E. J. Wheeler as general superintendent and the writer as field engineer.

Gas in Boston Tunnel

IN TWO of the shafts sunk last fall for the extension of the Boylston St. subway, at Boston, Mass., hydrogen sulphide gas was encountered. From the first it caused discomfort to the men by making their eyes water, and it was apparent that the condition would become unbearable or dangerous. To remedy this, a large galvanized-iron pipe was installed in the shaft, with branches that could be run into the tunnel drifts. At the surface the pipe was connected to a motor-driven fan operating as an exhauster. Fresh air then flowed down the open shaft. This method proved satisfactory and kept the work well ventilated, according to the annual report of Ernest R. Springer, chief engineer of the Boston transit department.

Tank Roof Floated Into Place

IN ERECTING a new 5,000,000-gal. water tank at Buchanan Park, Lancaster, Pa., the steel erector eliminated the need for roof falsework by erecting the dome roof at the bottom of the tank on wood pontoons equally spaced around the circumference and then floating the roof to top position. The tank is 100 ft. in diameter, 91 ft. high and involves 875 tons of steel shapes and plates. The framework of the roof consists of 6-in. I-beams, 4x4x⅜-in. angles and ⅞- and 1-in. tierods. Roof plates ⅜ in. thick are used, and the entire roof is welded. The pontoons measured 5 ft. high, 6 ft. wide and 7 ft. long and had a lifting capacity of about 10,000 lb. each. They were made as compact as possible, and as soon as the roof was ready for erection the water was admitted to the tanks to a height of about 4 ft., allowing the pontoons to absorb water and become absolutely tight before the final lift was made. Water was supplied through a 24-in. inlet connection, and the roof was moved up at the rate of about 18 in. per hour. About 36 hours elapsed before the roof was landed in place and

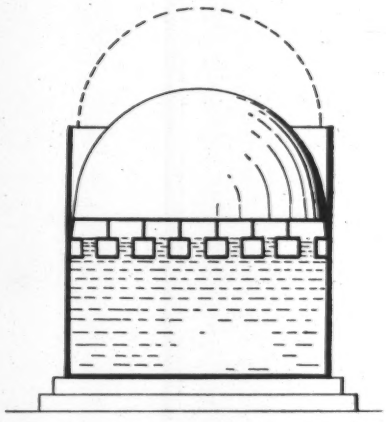


Fig. 1—Floating a 100-ft.-diameter tank roof into place, using a series of timber pontoons spaced around the circumference

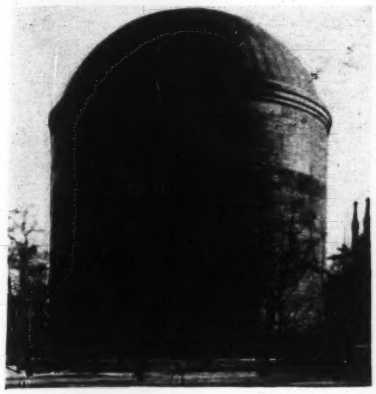


Fig. 2—New Buchanan Park water tank at Lancaster, Pa., with a diameter of 100 ft., height of 91 ft. and a capacity of 5,000,000 gal.

connected to the shell. The pontoons were then disconnected from the roof rib, the tank was emptied and the pontoons were broken apart and removed through the manhole. The tank was erected by McClintic-Marshall Corp., with J. L. Wisner as manager of erection.

Extending the Digging Range of a Dragline or Crane

THE DIGGING RANGE of the ordinary dragline or crane can be extended several hundred feet by using the machine as the basis for a cableway excavator, according to Sauerman Bros., Inc., Chicago, Ill. While the line speeds of cranes and draglines are usually slower than those of regular drag scrapers and the rope capacities of the drums are limited, it is nevertheless true that most such units can be converted to drag-scraper operation without mechanical alteration other than lagging the drums. The regular drag cable is replaced with a longer cable that attaches to the front chains of a scraper bucket. The regular hoist cable, likewise, is replaced with a longer cable that leads over the sheave at the tip of the boom and out across the excavation to a movable tail anchorage. This second cable serves as an inclined track line for the carrier and bucket. There is no swinging, raising or lowering of the boom, which is held at its maximum elevation during the entire operation. Occasionally it is desirable to provide a guide cable when the digging is particularly difficult. While the bucket is digging and bringing in a load, the track line is slacked off. When the bucket arrives at the dumping point the operator pulls this cable taut by a few revolutions of one drum, thereby raising the bucket into the air. As the bucket is bottomless, it deposits its load automatically when it is lifted. Then the load cable is slacked off and the carrier, impelled by gravity, carries the empty bucket back down the inclined track cable to the place of excavation. In equipping a boom machine with a scraper bucket it is usually practicable to use one of substantially larger capacity than the standard dragline bucket for which the machine is rated.

Concreting a Lakefront Wall at Milwaukee

By J. D. Levin

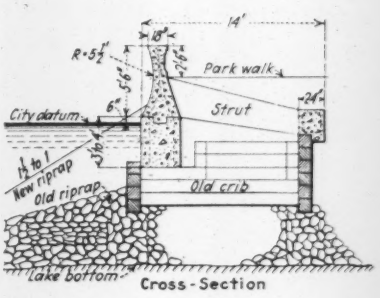
Babb, Mont.

CLOSE adherence to the time schedule and plan mapped out by the contractor, characterized the construction of 5,000 lin.-ft. of reinforced-concrete waterfront wall in the lake shore park development at Milwaukee, Wis., which was completed in 200 working days in 1931.

This work involved removal of the upper part of the old timber crib, placing reinforced-concrete beams, building the wall and placing stone riprap (200 lb. per cubic foot). Riprap was placed to about 4 ft. above lake level as protection from the breaking up of ice in the spring. The pockets between the anchorage beams at the rear were filled with riprap to stabilize the structure.

With the specification requirement for expansion joints 25 ft. apart, the plan was adopted of utilizing 25-ft. sections as the unit of daily progress. Steel forms were adopted on the score of economy. Simplified handling, setting and stripping, better finished concrete surfaces and the greatest number of reuses possible were among the reasons for their selection in preference to wood forms.

For the concrete beams, forms of steel plates stiffened with riveted and welded angles were assembled on the shore in 25-ft. lengths, with pipe spreaders and bolts to hold the forms together. After the reinforcing steel had been wired to the spreaders of the form, the crane set the prepared unit in place, and the form was lined and braced. It was calked with sandbags at the bottom to prevent leakage of concrete.



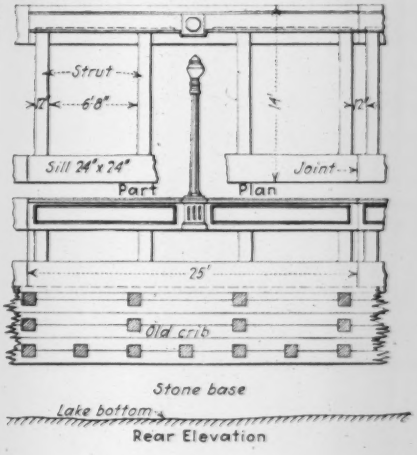
Cross-Section

Traveling concrete plant that built 5,000 ft. of wall.

Steel forms conforming to the outline of the wall were manufactured of steel plates stiffened by angles riveted and welded to the plates and were made in knockdown sections 2 ft. long. One set of these forms for a 25-ft. length sufficed for the entire 5,000 lin.-ft. of wall and was re-used 200 times. Steel forms similar to those for the longitudinal beams were used for the transverse anchor beams, which were concreted monolithically with the wall.

The daily cycle of operations was as follows: 8 to 9 a.m., set forms and reinforcing steel for supporting beam; 9 to 11 a.m., place concrete for beam; 11 a.m. to 1 p.m., move concrete mixer.

Lakefront wall for park extension at Milwaukee, Wis.



Rear Elevation

tower and chute into position for concreting superstructure; 1 to 4:30 p.m., place concrete for superstructure. In the morning another crew stripped the superstructure forms that had been concreted the preceding day. This latter crew also cleaned, oiled and reset these forms ready for concreting at 1 p.m. Both crews then participated in concreting the superstructure. The concreting plant consisted of a crawler paving mixer upon which the contractor had mounted a steel hoisting tower with a ¼-yd. bucket, flexible chute and a swinging pole boom for handling the wall forms. All concrete was spouted directly from this rig into the forms. A typical concreting crew comprised one operator, four men handling cement, sand and aggregate, and two men at the distributing end.

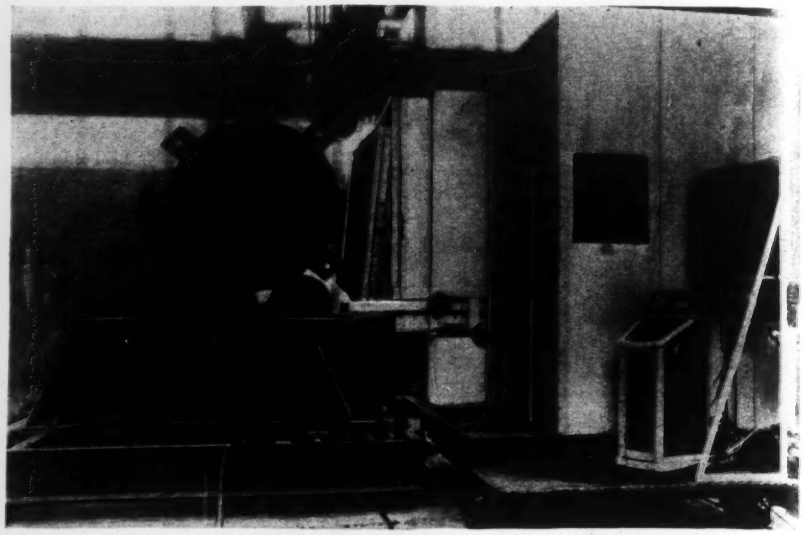
The general contractor was the firm of Bentley Bros., Inc., Milwaukee, Wis., with the writer as job superintendent. Steel forms were made specially by the Metal Forms Corp., also of Milwaukee. Albert Riemenschneider was engineer in charge for the board of park commissioners.

Shipbuilding Plant Installs Portable X-Ray Apparatus

FOR ITS routine examination of welded seams in pressure vessels, the Sun Shipbuilding & Dry Dock Co., of Chester, Pa., recently installed a portable X-ray apparatus. Flexibility and convenience of the apparatus have been secured by a coordinated system of supporting and rotating the vessels being examined and of supporting and shifting the X-ray tube. As shown in the accompanying illustration, the vessels are supported on two sets of gear-driven rolls, each set mounted on a substantial truck. These trucks are movable along a track to accommodate vessels of different lengths or to clear protruding nozzles, etc. The roll and gear units likewise are movable across the trucks to accommodate vessels of different diameter.

The X-ray generator and tube are mounted on a car that is movable parallel to the vessel track. The tube is inclosed in a lead-lined box mounted in trunnions so that it can be readily tilted. The trunnion frame is movable across the car sufficiently to permit proper approach to a vessel only 2 ft. in diameter on the one hand and proper clearance of nozzles protruding 2 ft. from a vessel 12 ft. in diameter on the other hand. The X-ray car is moved along the track by a slow-speed electric drive controlled from a portable push-button station. The vessel on the tank stands is rotated by a worm-gear drive, which may be actuated manually or electrically.

The auxiliary lead shields, which are



Portable X-ray apparatus with high-voltage equipment and X-ray tube in housing at right. Vessel to be examined is mounted on adjustable truck at left.

between the X-ray box and the outer surface of the vessel, are attached to the box itself and adjust themselves to the contour of the surface as the tube is moved into position. Similarly auxiliary shields attached to the film carrier adjust themselves to the contour of the inner surface when the carrier is placed in position. The films themselves are contained in inexpensive folders weighing but a few ounces each.

The transformers for producing the high-voltage current to excite the X-ray tube and all the high-voltage connections are inclosed within a metal housing on the X-ray car. The entire installation, which was made by the St. John X-Ray Service Corp., of New York, is under a craneway and adjacent to a railway track.

Mechanical Aids to Concrete-Mix Design

By F. T. Mavis

Associate Professor of Mechanics and Hydraulics, University of Iowa, Iowa City, Iowa

IN CONCRETE-MIX designing, the typical job-curve equation is generally of the exponential type suggested by Abrams

$$S = \frac{A}{B^{\frac{w/c}{7.5}}} \qquad (1)$$

This formula may be plotted as a straight line on semi-logarithmic paper, or, on construction jobs where such paper is ordinarily not available, the equation may be solved mechanically by means of a slide rule, pencil and a sheet of paper. The procedure is as follows:

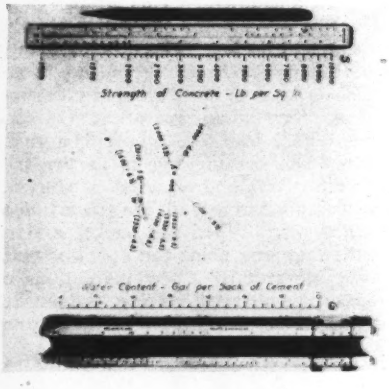
Draw two parallel lines S and G, as shown in the accompanying illustration, at any convenient distance apart—say 7 in. Remove the slide from the rule, lay the C scale along S and the scale of equal divisions along G. Transfer the graduations of the C scale to the line S and the graduations of the scale of equal parts to the line G. Number the graduations of the S and G scales to correspond respectively to the graduations of the C and uniform scales of the slide rule as shown. These two lines are the basis of diagrams for calculating any equation of the above type. Let the graduations on the scale S represent the strength of concrete cylinders in pounds per square inch, and the graduations on G represent gallons of water per sack of cement used in the mix.

The following examples will explain the use of the diagram:

Example 1: According to Abrams' curve,

$S = 14{,}000/7^{w/c}$, the 28-day strength of concrete cylinders made with 7.5 gal. of water per sack of cement is 2,000 lb. per sq.in., and the corresponding strength of cylinders made with 4 gal. of water per sack of cement is 4,960 lb.

Using a slide rule to solve exponential water-cement ratio equations



per sq.in. Calculate the 28-day strength of cylinders containing 10 gal. of mixing water per sack of cement. Draw a straight line between the point 4,960 on *S* and the point 4.0 on *G*. Draw another straight line from the point 2,000 on *S* to the point 7.5 on *G*. These two lines intersect at point *A*, and any straight line that passes through this point intersects the curves *S* and *G* at values of 28-day strength and quantity of mixing water respectively that satisfy Abrams' formula. Thus a straight line through the point *A* and the point representing 10 gal. of mixing water per sack of cement on *G* intersects the curve *S* at the point 1,040 lb. per sq.in.

Example 2: The average strength of concrete cylinders of age 7 and 28 days for various amounts of mixing water is given in the following table for a certain job:

Gallons of Water Per Sack of Cement	Strength of Test Cylinders — Age 7 Days	Age 28 Days
4.8	2,550	4,100
5.5	2,010	3,330
6.3	1,400	2,620
9.3	.....	1,100

Draw job curves of the exponential type (1).

The accompanying illustration also shows the solution of this problem. The lines connecting the corresponding points *S* and *G* for the 28-day test have a common point of intersection, *M*, and a curve of type (1) passes through all four points.

The three lines connecting corresponding points of *G* and *S* for the 7-day tests give three points of intersection as indicated. This means that a single curve of type (1) cannot be found that is in perfect agreement with the test data, but the curve that is in the best agreement with the test data may be constructed, using point *W*, which is the center of gravity of the three points of intersection.

Grit Sprayer Blots Tarred Roads Direct From Windrow

A MACHINE that picks up sand or stone chips from a windrow along the edge of the road and sprays them evenly to any width up to 24 ft. has been widely used by German roadbuilders for covering oil- or tar-treated surfaces. Following the pressure distributor, special-body carts deposit the blotting material in an even windrow of the required volume section. The grit-spraying machine propelled by motor and guided by hand picks up the cover material with revolving brushes and sprays it evenly over the treated roadway. The spraying machine is shown in operation in the accompanying illustration. It has a 7-hp. motor and is operated generally by one man. The illustration shows the clean pick-up and the even spreading. The speed of operation is great enough for the blotting to keep pace ordinarily with the oil or tar distributor.

Machine spraying blotting material from windrow over tarred road surface

Job and Office Notes

FOR DETERMINING the durability of bridge paints, the engineering department of the Nashville, Chattanooga & St. Louis Railway is using a simple test method described recently in the *Dutch Boy Quarterly*, published by the National Lead Co. A steel saucer about 5½ in. in diameter and ⅝ in. deep, made from 22- or 24-gage sheet metal, is given a priming coat of red lead and linseed oil, inside and out. Half of it is then painted with the road's standard finishing coat, and the other half with the paint to be tested. Considerable care is exercised not to break any of the paint on the edges. The saucer is then placed, with others under test, in a wooden rack. Cinders from the stack of a locomotive are placed in the saucer, and water is added. The water level is maintained by frequent inspection, and observations of the condition of the paint are made every six months. For identification a numbered copper tag is attached to each saucer.

▼

RAISED EDGES for concrete-pavement slabs to carry stormwater to spillways and thus avoid washing of shoulders are proving effective for the Tennessee state highway department. The concrete forming the raised edge is placed by hand immediately following the laying of the slab and before the latter has started to set. The raised edge is about 1 ft. wide, tapering from a thin section on the inside to a depth of about 3 in. at the outer face of the slab. The taper is so shaped that cars traveling at high speed experience no hazard in striking it at an angle. Water is carried away from the pavement by concrete-lined spillways extending across the shoulder.

· *Letters to the Editor*

New York State Diverts 32 Millions of Gasoline Tax

Sir—Diversion of motorists' taxes is receiving increasing attention. The sentiment on all these occasions was strongly opposed to the diversion of such revenue for purposes other than highway construction. The situation in New York State might be of interest to your readers.

At the last session of the legislature the gasoline tax was increased to 3c. per gallon, and on certain types of motor vehicles a 65 per cent increase in the vehicle registration fees was imposed. These increases as estimated will amount to $21,000,000 this year, and the law specifies that all of them shall be used for the general expenses of the state government.

Subdivision 3 of section 289 D of the tax law relative to the normal 2c. gasoline tax provides that the 75 per cent retained by the state, after the refunds to the counties and New York City have been made, "shall be paid into the state treasury and shall be appropriated and used for the construction, maintenance and repair of highways and bridges under the direction of the superintendent of public works." Subdivision 4 of section 73 of the motor-vehicle law relative to the normal registration fees provides that "All moneys paid into the state treasury pursuant to this article shall be appropriated and used for the construction, reconstruction and maintenance and repair of highways and bridges under the direction of the superintendent of public works."

The entire income to be derived from the normal and increased taxes during this year from these two sources is estimated at $93,000,000. Of this amount $21,000,000, representing the increased taxes is to go to the general fund of the state. Of the remainder of $72,000,000, $18,000,000 will be refunded to the counties and New York City, which leaves the amount of $54,000,000, which in accordance with these two statutes should have been appropriated for highway purposes under the direction of the superintendent of public works. The legislature, however, has only appropriated of these taxes an amount of $21,840,000, leaving approximately $32,000,000 of the motorists' money that has been illegally diverted.

The total revenue of $93,000,000 to be derived from these sources of taxation represents one-third of the entire state budget. We do not believe that the motorists as a class should be compelled to assume such a burden, and further, that only a sufficient tax should be imposed to carry on a normal highway program and that all of such revenue should be devoted to such purposes.

HARRY R. HAYES,
Managing Director, New York State Highway Chapter, A.G.C.

Albany, N. Y.,
April 29, 1932.

NEWS OF THE WEEK

Col. Ferguson to Head Mississippi River Commission

Washington Correspondence

ON JUNE 15 Col. Harley B. Ferguson will succeed Brig. Gen. Thomas H. Jackson as president of the Mississippi River Commission. The appointment is significant in view of Col. Ferguson's advocacy of a plan for increasing the discharge capacity of the Mississippi River between Arkansas City and Red River Landing. This would have an important effect on the proposed diversion through the Boeuf basin. Col. Ferguson also is chairman of the board of engineers which now is engaged in a review of the project adopted by Congress May 15, 1928.

Gen. Jackson will not reach the retirement age until Jan. 18, 1938. He is being relieved of his present duties in accordance with the policy of the Corps of Engineers which provides for change of station each two years. Gen. Jackson will have served in his present assignment for 2½ years.

Col. Ferguson was born at Waynesville, N. C., Aug. 14, 1875. He was graduated from West Point in 1897. At the outbreak of the World War he organized the 105th Engineer Regiment of the 30th Division and commanded that organization in France.

Sewer Gas Kills Engineer Attempting Rescue

In a heroic but futile attempt to rescue a sewage-plant operator from a sampling chamber in Lima, Ohio, on May 4, Earl Ivan Roberts, sanitary engineer with Harvey P. Jones & Co., Toledo, was asphyxiated by sewage gas. The operator was taking samples of sludge in a manhole about 8 ft. deep and when coming out slipped back, fracturing his skull. Mr. Roberts made two attempts to extricate him. On the second attempt Mr. Roberts was overcome by gas which had collected in the chamber.

Gas Leak Found Near Wrecked Ohio State Building

Investigation is proceeding into the cause of the explosion in the state office building at Columbus, Ohio, on April 14, which caused $1,000,000 damage and took the lives of ten workmen (*ENR*, April 21, p. 597). A break has been discovered in the gas main about 40 in. under the sidewalk 15 ft. from the west wall of the building. This break is described as being 11 in. long and about one-twentieth of an inch wide at its widest point. One theory is that gas escaping from the main through this leak accumulated and was exploded in some manner. The Ohio Fuel Gas Co., through its officials, denies that the leak was responsible for the explosion and insists that the break in the main was caused by the explosion and was not the cause of the catastrophe.

The official investigating committee appointed by Gov. White in a tentative report several days after the explosion said that it was caused by an accumulation of gas in the subcellar of the building.

Hetch Hetchy Bond Issue Carried by Over 12 to 1

Complete returns of the referendum in San Francisco on May 3 on the issuance of $6,500,000 Hetch Hetchy bonds show that the issue was approved by a vote of 126,634 to 9,390.

Detroit Water Board Drops 130 Men From Payroll

More than 130 men, about one-third of the total salaried staff, were dropped from the payroll of the Detroit department of water supply on May 3 in the adoption of an economy program designed to save $388,000 a year. Among the men discharged are the superintendent and the assistant superintendent of construction machinery, the engineer of the water system, the engineer of inspection and tests, the assistant superintendent of maintenance, a score of foremen and nearly a score of engineering assistants. The entire construction staff is eliminated and the department is placed on a maintenance basis. The board's revenues have shrunk $1,000,000 this year, it is stated.

Public Works for Trade Recovery Indorsed by Civil Engineers

A PROGRAM of public-works construction as the most effective way of increasing purchasing power, stimulating trade recovery and reviving employment was approved by the American Society of Civil Engineers in a resolution adopted by its executive committee on May 9. The action of the executive committee came as the result of an urgent appeal made to the board of direction of the society by a group of members for action by the society in the present emergency. An outline of a program of public work to stimulate trade recovery was presented to the board and it was urged, if it approved of the program, to appoint a committee vested with wide powers to represent the society in hearings upon legislation which may be considered by Congress for putting such a plan or a similar plan into effect.

The executive committee, after considering the proposal approved of it and authorized the appointment of the committee.

The resolution of the committee follows:

Whereas all buying has been curtailed by the loss of employment and reduced incomes, fear and uncertainty as to the future, and declining commodity prices; and

Whereas present trends indicate that trade will decrease and unemployment will increase until a more nearly normal purchasing power has been created; and

Whereas it will be more difficult to relieve unemployment during the next year than was practicable during the past winter through relief funds obtained from public and private agencies; and

Whereas a large amount of planned, productive and necessary public-works construction is now held in abeyance due to present difficulties in its financing; which if financed would aid in increasing trade and relieving unemployment; and

Whereas the construction of worthy public works could be expedited by extending federal loan facilities, under proper safeguards, to solvent states, counties and municipalities; and

Whereas it is more economical and advantageous for the nation and its subdivisions to meet current capital carrying charges on expenditures for productive public works than to provide for extensive, non-productive and demoralizing doles; and

Whereas there has been drafted a memorandum entitled, "A Normal Program for Public-Works Construction to Stimulate Trade Recovery and Revive Employment," which sets forth the principle that through such a program the restoration of normal purchasing power can be made promptly effective; therefore be it

Resolved, That the American Society of Civil Engineers, through its executive committee, (1) approves in principle a normal program of public-works construction as the most effective immediate means of increasing purchasing power, stimulating trade recovery and reviving employment; and (2) urges on the Congress of the United States the enactment of the necessary legislation to extend federal loan facilities to solvent states, counties and municipalities to enable them to carry out their normal programs of necessary and productive public works.

The program for public-works construction approved by executive committee of the society includes a full statement of the effect of the present depression upon the construction industry and how in turn the falling off of construction reacts upon all business generally. Further, it points out that there is at least $3,000,000,000 of work by states, counties and municipalities that is ready to go forward if funds can be provided.

The legislation necessary to provide the funds could, according to the report, be based upon that which has already found successful application in the Reconstruction Finance Corporation—that is, the credit of the federal government could be extended to reinforce the securities of states, counties and municipalities that may be issued to finance necessary and useful public works. It is possible that this function might be assigned directly to the Reconstruction Finance Corporation or to some affiliated agency. If this be not feasible, an independent but analogous agency should be set up for this purpose.

The executive committee has urged upon American Engineering Council, upon the local sections of the society and upon the members of the construction division active support of the proposed program of public construction.

The program will be given in more detail in a subsequent issue.

New York Pier Destroyed by Fire; Engineer Is Killed

FIRE on May 6 destroyed pier 54, at Thirteenth St. and the North River, New York City, occupied by the Cunard Line. One man was killed, a score of firemen were injured and property damage estimated at more than $2,000,000 was done before the fire was brought under control more than 24 hours after it started.

The superstructure of the pier was of fireproof construction—concrete floor and steel superstructure—but it was supported on a wood piling and timber substructure. The piles were untreated and the stringers and decking were of creosoted timber. The structure was built about 26 years ago.

Fire Marshal Brophy announced after an investigation that the blaze had undoubtedly been started by heat generated in boilers in the pier's heating plant. The heat penetrated to the wooden sleepers under the boilers, he said, causing the slow carbonization of the wood which finally was charred to the point of ignition.

Pier employees discovered the fire and spent half an hour attempting to extinguish it before they turned in an alarm. When the city firemen arrived the flames had spread considerably in the timbers underneath the concrete floor of the pier. Firemen were hampered in fighting the fire by the concrete floor, which barred access from above, and by fender timbers along the side, which were torn away with difficulty because of the dense smoke.

Under the terms of its lease, it is stated, the Cunard company must rebuild the pier, and plans are being made for its immediate reconstruction.

Fire hose kills engineer

The one fatality was that of Ralph A. Kluge, an engineer associated with the architectural firm of Cross & Cross, of New York City. Mr. Kluge had been employed by the Phoenix Bridge Co., of Phoenixville, Pa., when the pier was built and had assisted in the design of the steel superstructure. He was a spectator at the fire when a hose attached to a hydrant broke loose and its metal cover struck him on the back of the head. He was removed to a hospital, where he died of a fractured skull.

Mr. Kluge was born in Elmira, N. Y., in 1882 and after being graduated from the University of Pennsylvania was assistant to the chief engineer of the Reading R.R. and later city engineer of Harrisburg, Pa.

Moffat Tunnel Bond Fight Reaches State Supreme Court

The fight to invalidate $8,750,000 supplemental Moffat Tunnel bonds has been carried to the Colorado state supreme court, following a recent decision by the U. S. circuit court of appeals which upheld legality of the issues.

The brief attacking the Moffat Tunnel Commission's authority to issue bonds over and above the $6,720,000 contemplated in the legislative bill that loaned Colorado's credit to the enterprise was filed by the Denver city attorney's office as a "friend of the court."

NEW PRESIDENT, A.W.W.A.

George W. Pracy, installed as president of the American Water Works Association at its recent meeting in Memphis, is superintendent of the San Francisco waterworks. He has been connected with the water-distributing system of the city since 1912, becoming superintendent of distribution in 1924.

Municipal Bond Trends

Recent Sales Small, With Increasingly Favorable Rates to Borrowers

Although municipal bond sales for April showed the lowest total in ten years and referenda on proposed new issues were disappointing, the sales for the month showed an increasingly favorable interest and yield rate, from the municipal viewpoint. A notable further drop in the cost of capital occurred the first week in May.

As to interest rates, the generally high figures of the first three months of the year, often 6, 5¾ or 5½, dropped in many instances to 5 per cent toward the end of April, then fell to 4¾ and even to 4½ and 4.4 in a few cases in the week ended April 29, with still lower rates the following week. The corresponding yield rates were still lower, indicating a ready and improving market.

The better terms thus suggested were realized during the week ended May 5, when a large issue of 4½s and two good-sized issues of 4¼ per cent bonds sold readily and were reoffered by the buyers at still lower yield rates: Boston, Mass., $4,856,000 of 4½s, 1933-52 and 1982, reoffered to yield 3 and 4 per cent; Albany, N. Y., $1,940,000 4¼s, 1933-72, reoffered at 3 to 4.15 per cent; Middlesex County, Mass., $1,706,000 4¼s, 1933-47, reoffered at 2.75 to 4 per cent. During the same week $5,000,000 Nassau County, N. Y., 4½s, 1936-51, were reoffered at 4.3 per cent.

The small number and total of bond offerings in April and also for the first four months of 1932—in both cases the smallest total sales in the past ten years—created a market shortage that accounts in part for the recent decline in coupon rates and the still lower yield on resale. According to *The Bond Buyer*, only $65,204,545 bonds were sold in April and $324,316,397 in the four months ended April 30. The lowest corresponding totals were in 1929—$87,343,450 and $358,503,108. Nearest to the figures just given are $89,030,844 and $343,666,000 in 1923. The maximum four months' total in the past ten years was $560,395,236 in 1931—$236,000,000 more than thus far in 1932. The average four months' sale for the period was about $116,000,000.

Referenda on proposed bond issues during April, although 52 in number, reports *The Bond Buyer*, made up the small total of $11,669,600. Approvals were 24 in number, with a total of $9,007,000 authorized; defeats numbered 28, but the total was only $2,662,600. Three of the approved issues account for $6,800,000 of the $9,007,000 that carried, leaving an average of only $105,000 for the 21 other issues. Most of the issues defeated were for small sums. The average for the entire 52 issues voted was $225,000.

Hoover Dam Notes

In the Arizona inclined spillway tunnel at the Hoover Dam only 12 ft. remained on April 30 between the heading of the 7x14-ft. pioneer tunnel and the inclined shaft which was sunk along the top of the inclined tunnel from the end of the adit. In the Nevada inclined spillway tunnel operations have been started for the cutting of a slot 14 ft. wide through the entire depth of the spillway tunnel. Enlargement to the 56-ft. section will be made from this cut.

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In tunnel-lining operations 2,521 ft. of invert had been poured on April 30. Pouring of the side wall lining in the diversion tunnels was started on April 28. All ramps and invert sections have been removed at the inlet ends of all diversion tunnels. Excavation for upstream tunnel plugs in tunnels No. 2 and No. 3 have been completed above the elevation of the invert section of the rock remaining in the tunnels.

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A record was made at the gravel pit during the week under review when 8,000 cu.yd. of material was loaded out within 24 hours. The screening plant classified 290 cars of aggregates and placed 10,000 yd. in finished storage piles. At the mixing plant 1,250,000 lb. of cement was prepared for the pouring in diversion tunnels.

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On April 26 the men working for Six Companies, Inc., totaled 2,598. Of that total 1,100 were engaged in the work on tunnels and spillways, while 700 were engaged in concrete operations.

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Two workmen were killed and another was injured during the week under review. One died as a result of a fall while engaged in cofferdam construction. The other casualties resulted from a fall of rock which broke the staging on the trimming jumbo, causing two men to fall 40 ft. to the floor of the tunnel.

Receiver Named for Detroit-Windsor Tunnel

George R. Cooke, president of the Detroit & Canada Tunnel Co., has been appointed receiver for the company by Federal Judge Arthur J. Tuttle. It is stated by the receiver that the property has sufficient income to meet operating expenses, but that because of curtailment of traffic due to the present depression the company has been unable to earn interest charges on its funded debt and is in default on its bond and debenture interest. The tunnel, which connects the business districts of Detroit and Windsor, Ont., was opened on Nov. 1, 1930.

William Barclay Parsons, Pioneer in Subway Construction, Dies

Designed and built New York's first rapid-transit subway system—Member of Isthmian Canal Commission and builder of Cape Cod Canal—Led American Railway Engineers in France

WILLIAM BARCLAY PARSONS, consulting engineer, who rose to a position of prominence in the profession through his notable work as chief engineer of the first subway system built in New York, died suddenly at the Presbyterian Hospital in New York on May 9. He had recently undergone two operations and was believed to be recovering when a relapse occurred.

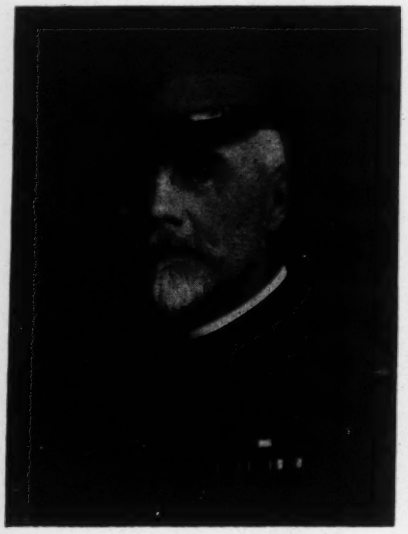
Born in New York in 1859, Mr. Parsons was graduated from Columbia College in 1879 and received the degree of civil engineer from the same school in 1882. His early work was in the maintenance-of-way department of the Erie R.R. and it was during this time that he wrote his first books, "Turnouts" and "Track," well-known works at the time. His railway work aroused an interest in urban rapid transit, especially in his native city of New York, where the subject was then being discussed actively. As a result he resigned his position with the Erie in 1885 and returned to New York to open an office as a consulting engineer. Among his first clients were people interested in promoting the construction of subways in New York, and it was the intensive study he then devoted to the subject that laid the foundation for his later success in this field.

During this same period Mr. Parsons built up a practice as a consultant to banking houses on projects which they were called upon to finance or which they had to take over to complete. In this work he served as chief engineer of the waterworks of several communities, including Vicksburg and Natchez, as consultant on mining operations in the coal and iron regions and as chief engineer or consultant on railway lines in the West and in Jamaica.

First subway work

In 1891 the New York state legislature authorized a commission to take measures looking toward construction of the long-proposed subways for New York City. The late William E. Worthen, then the dean of engineers in the city, was appointed chief engineer and Mr. Parsons was appointed deputy chief engineer. In 1894 that commission was replaced and Mr. Parsons was made chief engineer of the new commission. After early progress in the design studies had been made and the route laid down the project lagged due to legal difficulties and the outbreak of the Spanish-American War.

With the outbreak of the war Mr. Parsons entered the service as captain of one of the volunteer engineer regiments and later was appointed chief engineer, New York National Guard, with rank of brigadier general. Of that period he said in a letter to John M. Goodell, editor of *Engineering Record:* "I make no pretensions to being a hero. I did nothing more than stand ready to go to the front if occasion required. Fortunately, the war was a short one, and I shall go down, if in history at all, as an engineer and not as a soldier." Following the war Mr. Parsons was engaged for part of two years, 1898-99, in railway surveys in China, making 730 miles of surveys for a line from Canton to Hankow and 270 miles of reconnaissance on other lines, largely through regions never previously penetrated by foreigners. Subsequently a company was



William Barclay Parsons

organized to build the line and he was elected president and served as such for several years. His experiences during that period were recorded in a book entitled "American Engineers in China."

Late in 1899, legal difficulties in the way of the subway construction in New York having been eliminated, Mr. Parsons returned to this work. Contracts for the construction were let early in 1900 and work was soon under way. He continued as chief engineer until operation was started in 1904. That date marks the end of his active direction of the subway work, but he continued in a consulting capacity for twenty years.

Early in 1905 Mr. Parsons went to Panama as a member of the committee on engineering of the Isthmian Canal Commission and, together with Major Gen. G. W. Davis, governor, and William H. Burr, prepared a report favoring the construction of a sea-level canal. This report subsequently was adopted by the majority of the commission. A minority report, however, favored a lock canal and that report was approved by President Roosevelt in February, 1906.

Much of the period from 1904 to 1917 was devoted to city transit matters, first as adviser to the Royal Commission on London Traffic and then on the transit problems of San Francisco, Detroit, Cambridge, Baltimore, Chicago, Philadelphia, Toronto and Chicago. In 1916 Mr. Parsons was appointed chairman of the Chicago Transit Commission. In addition to this transit work he was chief engineer of the Cape Cod Canal from 1905 to 1911 and took an active part in the construction of the Steinway tunnel under the East River at New York and the Hudson & Manhattan tubes to New Jersey.

Army service

In 1916, when it appeared obvious that the United States would soon enter the World War, Mr. Parsons joined with other engineers in the promotion of an engineer reserve corps and in organizing a regiment of engineers at New York. Before war was declared he was commissioned a major in the reserve corps and immediately following the declaration he was called into active service. On May 14 he sailed for France as the head of an engineer commission to report to the Chief of Engineers as to what engineering services were most needed by the Allies. The same week the regiment which Major Parsons had helped to organize was called into service.

Upon the completion of the commission's report in July Major Parsons was reassigned to his regiment, the 11th Engineers (Ry.), U.S.A., as its lieutenant colonel. The regiment was then in England. From that time until the spring of 1918 he served as second in command, and from May, 1918, until the regiment was disbanded in May, 1919, served as its commanding officer except for about a month in the fall of 1918.

As one of the few officers in the regiment with any considerable experience in railway construction Col. Parsons devoted his time largely to its construction operations during the intensely active period when it was building railways behind the British front in the preparaton for the Cambrai offensive and when it was on railway construction with the American Army in the St. Mihiel and Argonne regions, also during the regiment's second tour of duty with the British on trench construction around Arras.

Col. Parsons' experience as commanding officer of the regiment was not without its difficulties, due to his outspokenness and his disregard for army red tape when he wanted something done, but despite efforts to have him removed from command he remained to realize his ambition to "lead the regiment up the main street of the city where I was born and with which I have been identified."

Following the War Col. Parsons was transferred to the engineer reserve corps, and in 1922 was appointed deputy chief engineer with the rank of brigadier general.

In recent years Gen. Parsons had devoted himself largely to his outside interests such as Columbia University, of which he was chairman of the board of trustees, taking an active part in the construction of the great medical center where he died. He also gave much time to research and writing. Soon after the war he wrote "American Engineers in France," a review of the activities of the engineer corps during the war; subsequently he wrote "Robert Fulton and the Submarine," and at the time of his death had about completed a four-volume work entitled "Engineering at the Beginning of the Renaissance."

For the past 25 years Gen. Parsons was a member of the firm of Parsons, Klapp,

Brinckerhoff & Douglas and its predecessor, Barclay Parsons & Klapp. In 1926 he was elected an honorary member of the American Society of Civil Engineers. For his war service he received the Distinguished Service Medal and numerous foreign decorations.

Gen. Parsons' most outstanding accomplishment will always be his service as chief engineer of the first subway system in New York. Of that service Robert Ridgway, the present chief engineer of the Board of Transportation says:

"Gen. Parsons served as chief engineer of the Board of Rapid Transit Commissioners from 1894 until the end of the year 1904. During his administration the contract for the first subway from the old post office to Broadway and 96th St., with branches to the Bronx and Van Cortlandt Park, was prepared and the work was substantially completed so that operation north to 145th St. was started in 1904. The contract was the largest one that had been let by the city up to that time and the work was of a pioneer character.

"The engineering staff was built up under Gen. Parsons' direction, and his selections were justified by the zeal and ability with which the work was carried on. Many of those whose engineering careers were initiated under Gen. Parsons are still engaged in the task of subway design and construction.

"Gen. Parsons inspired his staff with his own enthusiasm. He was an excellent disciplinarian. He was just in his dealings with his own force and with the subway contractors, all of whom had for him high respect and esteem. It was my privilege to serve under him and I know how much of the success of the project was due to his efforts. He was an able and loyal servant of the city of New York. The rapid-transit construction agency of the city today is proceeding substantially along the same lines as laid down by the city's first chief engineer of subway construction."

$6,000,000 Bridge Project in Cleveland Approved

The commissioners of Cuyahoga County, Ohio, have approved the construction of the Main St. high-level bridge, Cleveland, and have authorized the issuance of $6,000,000 in bonds to cover the cost. The project has been approved by the city of Cleveland, and the county commissioners have approved legislation authorizing the acquisition of land. However, land cannot be acquired until the bonds are sold.

The Cleveland Chamber of Commerce is opposing the project on the theory that the county should not bond itself further at this time. The commissioners, on the other hand, believe that now is an opportune time not only because of low prices for construction and materials but also because work for a year or so would be given many men who otherwise would have to be supported by charity.

The preliminary design calls for a structure about 3,000 ft. long exclusive of approaches, composed of reinforced-concrete approach spans and a steel half through arch—flanked by steel arches—for the channel span. The bridge will have a 60-ft. roadway and two 5-ft. walkways. The maximum grade on the approaches will be 3 per cent. For the three steel river spans deep caisson work will be required. It may be necessary even to go to rock, which at the site is about 140 ft. below ground surface.

Designs for the structure are being prepared by the consulting engineers, Wilbur Watson & Associates, Cleveland. A. M. Felgate is the county bridge engineer.

H. J. Kaiser New President of Associated General Contractors

Henry J. Kaiser, who was inducted into office as president of the Associated General Contractors at the spring meeting of the executive board in Washington on May 2 and 3, succeeds by virtue of his office as vice-president at large the late William A. Starrett, elected president at the annual convention in January. Mr. Kaiser is a roadbuilder and general contractor of long standing on the Pacific Coast and is vice-president of Six Companies Inc., which has the contract for the Hoover Dam. One of his large operations just previous to his Hoover Dam work was the construction of one of the longest sections of the Central Highway of Cuba. Taking his new office at the height of his business activity, Mr. Kaiser brings a wealth of energy and a close contact with construction problems that will be of great value to the association of which he is now the head.

D. J. Brumley Is President of Western Society

Announcement of the ballot vote on officers of the Western Society of Engineers for 1932-1933 includes: president, Daniel J. Brumley, chief engineer of Chicago terminal improvements, Illinois Central R.R.; vice-presidents, Harry B. Gear, C. C. Whittier and Leigh S. Keith; treasurer, Paul A. Westburg.

Pittsburgh's Planning Commission Personnel Reduced

Seventeen employees of the Allegheny county (Pittsburgh), Pa., planning commission, whose yearly salaries total $69,000, have been discharged, because, it is said, there is no program for their consideration at present. Among those dismissed is Coleman Murphy, chief engineer.

Concrete Pavement Yardage

Below is given a tabulation of concrete pavement yardage awarded in the United States during the month of April, divided according to roads, streets and alleys, and the totals for the four months' period ended April 30:

	During April	To April 30
Roads	10,366,044	21,159,190
Streets	673,487	1,617,483
Alleys	48,250	95,404
Total	11,087,781	22,872,077

Missouri Engineers Outline Plan to Cut Unemployment

METHODS by which it is believed serious unemployment can be prevented in the future are outlined in a report to American Engineering Council by the Missouri Committee on Engineers and Employment. Similar committees have been organized by Council in most of the states.

The Missouri committee believes that the working day must be shortened and that farming as a means of livelihood is worthy of wider consideration. There exists now, the committee points out, more than sufficient agricultural land available for cultivation than is needed to supply the needs of this country alone. Much of this land should be turned into forest land and game preserves, reserving the better agricultural lands for farming. In this the committee believes all states should take a hand, as a few states have.

Building up of reserves for dull times by both individuals and corporations is, according to the committee, essential to any plan of stabilizing employment. Further, industries, instead of laying off their engineers and technical men in dull times, should set them to preparing plans and specifications for future expansion. The committee hopes that many plans for building up reserves in good times and for spreading employment over dull times will be tried out.

Needed public works

This committee, like the Michigan committee (*ENR*, April 28, p. 633), sees in the construction of needed public works, such as sewers, water supplies, schools, main highways and rural roads, a field for the wise expenditure of public funds. This work, it believes, should be done in times of depression.

The committee would not have any municipality undertake the construction of utilities which can be built by private enterprise. Supplying water to suburban communities and towns it puts in this class.

Taxation needs a complete restudy, the committee believes, as does local government. Many counties in Missouri, it states, could be consolidated and elective officers such as highway engineers should be appointive.

Annual Welding Congress at Portland, Ore.

The fourth annual Pacific Northwest Welding Congress was held in Portland, Ore., April 28-30 under the sponsorship of the Portland Section of the American Welding Society. Illustrations of various applications of welding in industry were exhibited by 21 firms. Demonstrations of electric arc and gas welding were carried on continuously. Seven hundred delegates from the Pacific Northwest and California registered.

Outstanding educational features at the business sessions were discussions of practical welding methods by H. B. Isings, Woodberry & Co., Portland, and of hard surface methods by Ralph S. Beeler, J. E. Hazeltine & Co., Portland.

Chicago Engineering Council Is Formed

Sixteen local sections of technical societies, the Western Society of Engineers, the Chicago Engineers Club and the Western Railway Club have formed the Chicago Engineering Council, with J. M. Fitzgerald and J. deN. Macomb, secretary, as temporary officers. The object is to supply a medium for exchange of ideas where unified action is desired. Interchange of information as to meetings and programs is one subject. Another is arrangements for handling engineering information and registration during the period of the Century of Progress in 1933.

Capital and Contracts

Total value of engineering construction contracts for the United States for the week of May 12, 1932, also new capital issues, together with year-ago comparisons, follow:

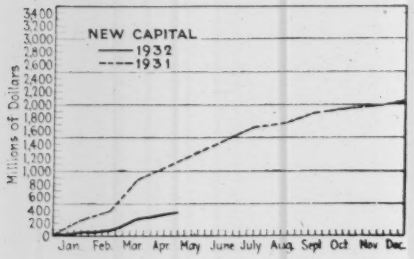
(Thousands of Dollars)

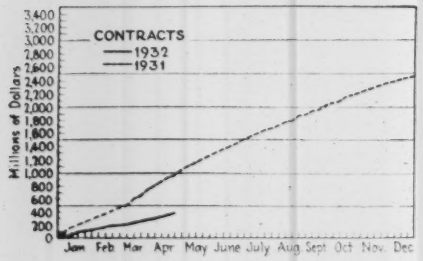
Construction:	Week of May 12, 1932	Average Week May, 1932	Average Week May, 1931
Federal government	$2,667	$3,649	$2,585
State and municipal	15,036	13,254	27,924
Total public	$17,703	$16,904	$30,509
Total private	7,246	6,899	23,949
Week's total	$24,949	$23,803	$54,458

New Productive Capital:	Week of May 7, 1932	Average Week April, 1932	Average Week May, 1931
Public	$16,000	$9,800	$47,000
Private	.....	8,800	40,000
Week's total	$16,000	$18,600	$87,000

Cumulative Construction and Capital, Jan. 1 to May 12:

1932, construction	$396,846
1931, construction	1,098,454
Decrease, 64 per cent	
1932, capital	$358,000
1931, capital	1,091,750
Decrease, 67 per cent	





ENR Index Numbers

Cost		Volume	
May, 1932	**152.78**	**April, 1932**	**135**
April, 1932	153.12	March, 1932	97
May, 1931	189.33	April, 1931	289
1931, average	181.35	1931, average	220
1930, average	202.85	1930, average	260
1913	100.00	1913	100

Personal Notes

BURGIS McCOY has been named city engineer and assistant commissioner of public works of Fort Collins, Colo., to succeed E. A. Lawver, resigned. Mr. McCoy was a member of the engineering staff during the construction of the Moffat tunnel.

CHARLES R. PETTIS, lieutenant colonel, Corps of Engineers, has been relieved from his assignment at Fort Logan, Colo., and assigned to duty as engineer, Fifth Corps Area, Fort Hayes, Ohio.

PAUL D. COOK, of New Orleans, La., has been appointed city engineer of Sioux City, Iowa, to succeed Leo. N. Hintgen, who has held the position for the past ten years.

CARL F. MEYER, formerly city engineer of Eau Claire, Wis., has organized Engineering Service, Inc., and will specialize in municipal engineering, surveying, estimates, investigations and reports for individuals, public service corporations and municipal corporations.

Obituary

DONALD M. RYERSON, chairman of the board of Joseph T. Ryerson & Son, Inc., steel manufacturers, of Chicago, died on May 8 as the result of a self-inflicted bullet wound. Mr. Ryerson, who was 47 years old, was graduated from Yale in 1907 and soon afterward entered the steel corporation founded by his grandfather in 1842. He became chairman of the board in 1928 on the death of his father. A coroner's jury found that Mr. Ryerson was driven to self-destruction by a nervous breakdown caused by overwork.

HARRY H. BARROWS, assistant chief of the U. S. Bureau of Agricultural Engineering, died suddenly of a heart attack on May 3 at his home in Washington. Mr. Barrows was 58 years old and had been connected with the bureau for 22 years, having held the positions of drainage engineer, assistant drainage engineer and assistant to the chief.

CHARLES NORMAN BARCLAY, of Montreal, died at Philipsburg, Que., on April 30 at the age of 55 years. Mr. Barclay was born in Scotland and went to Canada in 1883. He spent several years in railway work in Cuba and was engaged for some years in construction in the United States. He also had engineering experience in various parts of Canada.

JOSEPH O'CALLAGHAN MIGNAULT, of Sherbrooke, Que., died on April 30. Mr. Mignault, who was a graduate of McGill University, was for some time engaged as consulting engineer for the dominion department of public works, but of late years had been in private practice.

FRED NORLIN, an old-time surveyor and civil engineer of Chicago, died on April 24 at the age of 67. He was born in Sweden and came to this country soon after being graduated from the University of Upsala. In 1886 he was engaged with the Greeley-Carlson Co., surveyors, in Chicago, and in 1894 he began private practice, but in 1916 he organized the Greeley-Howard-Norlin Co., of which he was manager and treasurer until his death. For some years he was county surveyor of Cook County (Chicago). Mr. Norlin was a member of the Western Society of Engineers.

CARL J. RHODIN, consulting engineer with offices in San Francisco, was found dead at his home in Oakland, Calif., on May 3, a suicide. For more than a year he had been doing valuation work for the Pacific Gas & Electric Co. He was a member of the San Francisco Section, American Society of Civil Engineers, of the San Francisco Engineers' Club and the Commonwealth Club, of whose city planning section he was chairman.

ROBERT M. FEUSTEL, president of the Midland United Co. and an official of several other Insull utility corporations, died on May 8 at the age of 47. Mr. Feustel was graduated from Purdue University in civil engineering in 1905. From 1907 to 1908 he was assistant chief engineer for the Wisconsin Railroad Commission. He was the first chief engineer of the Illinois Utility Commission and served during 1913 and 1914.

SEDLEY H. PHINNEY, of Princeton, N. J., executive secretary of the New Jersey League of Municipalities, died in Trenton on May 9 of pneumonia. Mr. Phinney was born in Rochester 42 years ago and was graduated from the University of Rochester with the degree of bachelor of science in 1912 and received a degree in civil engineering from the University of Wisconsin in 1914. Besides his position with the League of Municipalities, Mr. Phinney was secretary of the New Jersey State Sanitary and Economic Water Commission and secretary of the National Coast Anti-Pollution League.

SOCIETY CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 20-24.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Yellowstone National Park, July 6-9.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 40th annual meeting, Oregon State College, Corvallis, June 29-July 1.

COLORADO SOCIETY OF SANITARY AND HEATING ENGINEERS at its 35th annual convention in Denver elected the following officers: president, E. H. Horton, Greeley; vice-president, E. B. Clayton, Denver; treasurer, H. W. McGee, Denver; secretary, Clyde A. Newman, Denver.

FOUR-STATES SECTION, American Water Works Association, with membership from Delaware, Maryland, southern New Jersey and eastern Pennsylvania, will hold its annual meeting at Atlantic City, June 7-8.

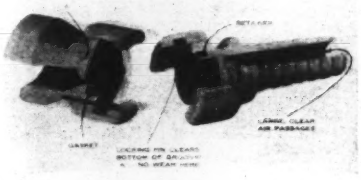
MID-SOUTH SECTION, American Society of Civil Engineers, at its annual meeting in Little Rock, Ark., on April 29, elected Roy E. Warden, Little Rock, president, and George R. Clements, Vicksburg, Miss., secretary-treasurer. Memphis was selected as the next meeting city.

NATIONAL ASSOCIATION OF RAILROAD TIE PRODUCERS for its annual meeting at Memphis, Tenn., May 17 and 18, includes on its program the following papers: "Relative Values of Various Sizes of Ties," E. A. Hadley, chief engineer, Missouri Pacific R.R.; "Comparisons of Different Species of Tie Timbers," H. Von Schrenk, consulting engineer; and "The Railroad Outlook," E. T. Howson, president, Wood Preservers Association. Roy M. Edmonds, St. Louis, Mo., is secretary.

Construction Equipment and Materials

All-Steel Air Hose Coupling

The Cleveland Rock Drill Co., 3734 East 78th St., Cleveland, Ohio, has placed on the market a snap-on air hose coupling made of bar steel, cadmium plated to prevent rust. The parts are turned out of a bar of steel and then heat-treated. The steel couplings are claimed to have much longer life than those made of bronze, malleable iron or other cast materials. Features of the new coupling, known as Type "Q," are a retainer that prevents the gasket from blowing out, large air passages and a design to prevent the locking points from wearing. The coupling is made in ½-in. and ¾-in. sizes, interchangeable, and available in pipe threaded ends with either male or female threads, or with hose stems.

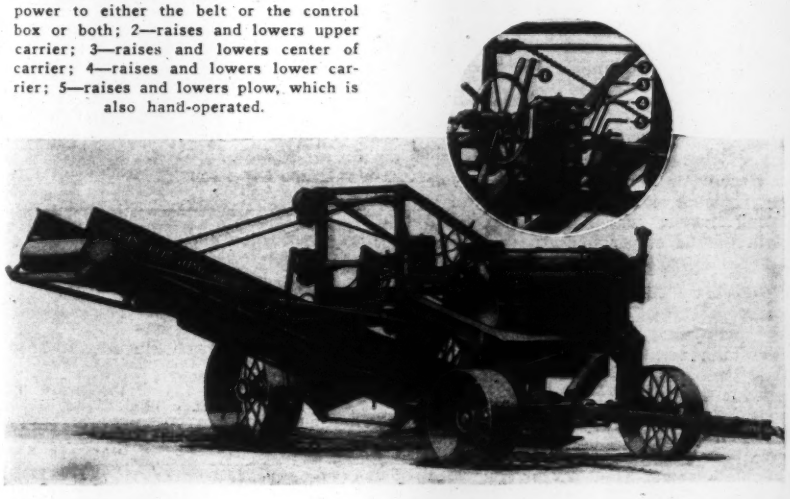


Cleveland all-steel air hose coupling.

Elevating Grader Is Motor Controlled

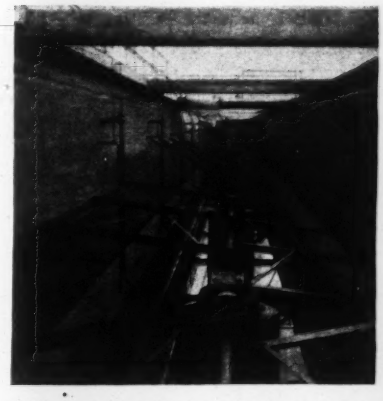
A new motor-controlled heavy-duty elevating grader is announced by J. D. Adams Co., Indianapolis, Ind. Besides the motor control, other new features of the machine, known as Elevating Grader No. 11, include a new type frame, front axle, plow beam design and a 48-in. carrier. The carrier and plow controls are power operated. The new frame and front axle construction eliminate the usual fifth wheel, providing better stability and balance. The plow beam takes draft directly at the tongue connection. Ball-bearing equipped, the 48-in. carrier is driven by shaft and gears. The carrier, claimed to be built exceptionally rigid, is available in lengths of 19, 22 and 25 ft. The operator, from his position at the plow, has immediate control of upper carrier, center of carrier, lower carrier and the plow, all raised and lowered by power through inclosed gears. Power for operating the controls and carrier is supplied through a power takeoff from the tractor or by an auxiliary McCormick-Deering power unit.

Adams power-controlled elevating grader. Control levers, shown in the inset, are: 1—master clutch lever which directs power to either the belt or the control box or both; 2—raises and lowers upper carrier; 3—raises and lowers center of carrier; 4—raises and lowers lower carrier; 5—raises and lowers plow, which is also hand-operated.



Sewage Aerator of Mechanical and Diffused Air Type

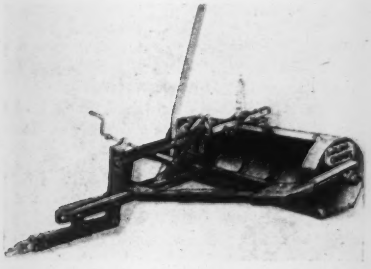
The Dorr Co., Inc., 247 Park Ave., New York City, has introduced the Dorrco aerator for general aeration work at sewage-treatment plants of the activated sludge type. This new aerator is of the combined mechanical and diffused air type, and is distinctive in that the rotary motion of the sewage, induced by the mechanism, operates in a direction countercurrent to that of the upward flow set up by the rising bubbles of diffused air. The Dorrco aerator is supplied in the simplex, duplex and multiplex types, this designation corresponding to the number of series of motor-driven paddles used for the agitation and circulation of the sewage. The mechanism consists of a multiplicity of paddlewheel units, attached at regular intervals to a single shaft which passes axially through the tank. The entire mechanism is below the water level. Embedded in the tank side or bottom are the porous tiles for admitting the diffused air. The paddles are driven downward against the stream of rising air bubbles. The equipment is arranged for installation in both new tanks and existing ones. It may be supplied in a wide range of diameters corresponding to various tank sections, and due to the sectional type of construction may be built up to any reasonable length, with or without multiple-drive units.



View of Dorrco aerator in an empty tank showing paddlewheel arrangement.

Automatic Rollover Scraper

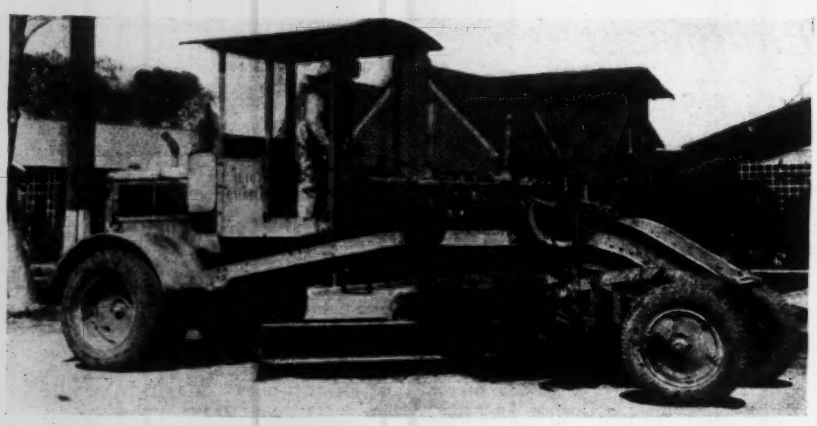
LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, has acquired the license to manufacture automatic rollover scrapers under the Reynolds patent. These scrapers, tractor-pulled, are one-man operated. They are built in five sizes with the following capacities: 18, 22, 27, 42 and 56 cu.ft. The width of bowl is 4 ft. and 5 ft. for the two smaller sizes, respectively, and 6 ft. for the three larger sizes. The scrapers have a simple tripping mechanism which allows them to be tripped while going forward or backward. When a load has been dumped, the bowl can be held in the dumping position, permitting the bottom of the bowl to be used as a bulldozer by backing up or as a spreader by pulling forward. All sizes of the scrapers are provided with a crank to adjust cutting depths to meet varying soil conditions. They are also equipped with an automatic and adjustable pressure release which lifts the cutting edge out of the ground when the scraper is loaded.



LaPlant-Choate automatic rollover scraper.

Steel Broom on Graders for Road Maintenance Work

A steel broom as a replacement unit for the cutting edge on any standard one-man maintainer or pull-type grader, known as the Speeder Road Broom, is now being manufactured by the Speeder Machinery Corp., Cedar Rapids, Iowa. This broom was formerly manufactured in the Pacific Northwest and was known as the Owen road broom. The broom, varying in width



Speeder road broom mounted on auto grader.

from 8 to 14 ft., replaces the mold board and cutting edge of the grader. The unit is recommended for gravel maintenance and for oil mix work. It is composed of steel wires 18 in. long which give when striking an immovable object, such as a deeply embedded stone, thus eliminating the ridge that would be caused by a grader blade jumping over it. No replacement of the broom is necessary until it is completely worn out. Its estimated life is one complete season. The broom is also built in a complete unit which it is not necessary to place on a grader chassis.

New Equipment in Brief

New 1½-Ton Truck—An oversize 1½-ton six-cylinder Indiana truck, powered with a 68-hp. Hercules L-head type engine, will be sold and serviced by the White Co., Cleveland, Ohio, at a price of $885. The truck, known as Model 85, has an allowable gross weight of 10,000 lb. Five wheelbases and a complete line of bodies for every truck need are available.

Welding Torch—Tips, Inc., 515 Cathedral St., Baltimore, Md., announces a new cutting and welding torch especially suited to the needs of contractors. The new torch, Type NVM, will cut and weld any thickness of metal within range of the process. A change of tips converts it from a cutting to a welding tool.

Improved Scales—The Kron Co., Bridgeport, Conn. (formerly American Kron Scale Co.), has improved its line of scales in both appearance and operating mechanism. In the dial mechanism 48 bearing points have been eliminated. The six remaining bearing points are a specially designed anti-friction type. The sector has been so designed that it offsets all vibration present in the building in which the scale is located. A one-point adjustment permits the scale to be readjusted quickly when necessary.

Circuit Breaker—A safe, flashless device known as the AB De-Ion circuit breaker has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to take the place of carbon circuit breakers or fuses now in common use. The breaker operates like a switch, and when tripped by an overload can be reclosed quickly without removing and replacing anything. It cannot be blocked to prevent opening of the circuit. A time lag prevents tripping on slight momentary overloads.

Safety Pushbutton—The safety electric pushbutton announced by Lincoln Electric Co., Cleveland, Ohio, last year has been improved. The starting button has been placed inside of a larger stop button. The stop button can be operated from any angle by merely striking the front of the control box with the flat of the hand; the start button must be operated with the finger.

Floor Coating—A floor coating containing a pigment three times harder than steel, insuring resistance against normal abrasion and wear on concrete and wood floors has been announced by the Medusa Products Co., Engineers Bldg., Cleveland, Ohio. Only one coat is required over previously painted surfaces or over Medusa primer, specified for use with the coating when applied to concrete floors not previously painted. The paint comes in light gray, dark gray, tile red, brown and black.

Steel Apron Conveyor—For long-time operation under exceptionally severe operating conditions, a steel apron conveyor with a gravity seal feature has been perfected by Webster & Weller Mfg. Cos., 1856 North Kostner Ave., Chicago. The gravity seal is based upon a new method of attaching the conveyor pans to the chains by means of a patented pivot link. This feature permits the pans to overlap so snugly as to prevent any leakage of material and yet provides sufficient flexibility to enable the conveyor to travel evenly and without strain on the sprockets.

18-Yd. Power Shovel—The Marion Steam Shovel Co., Marion, Ohio, is building an 18-yd. shovel equipped with a 95-ft. boom and mounted on crawler trucks. The shovel will be equipped with a movable counterbalance, located at the rear of the rotating frame, which will balance the weight of the empty bucket. The shovel is known as type 5560.

Synchronous Motor Starters—A new line of automatic and semi-automatic starters for synchronous motors is announced by Cutler-Hammer, Inc., 238 North Twelfth St., Milwaukee, Wis. Important in the operation of these starters is a frequency responsive relay which functions in connection with an adjustable time delay thermal overload relay. The starters are available in sizes from 25 to 600 hp. for voltages of 220, 440, 550 and 2,200 volts. Descriptive bulletins are available from the manufacturer.

New Publications

Bulk Cement Plants—The Butler Bin Co., Waukesha, Wis., has published two booklets covering bulk cement plants and the use of bulk cement. A 12-p. booklet is devoted to the use of bulk cement and the latest developments in complete bulk cement-handling plants. A 4-p. supplementary bulletin describes in detail a new semi-automatic bulk cement-weighing hopper known as the Electro-Interlocked bulk cement, weighing hopper.

Float Valves—Ross Valve Mfg. Co., Troy, N. Y., in its bulletin 32 describes its WR type altitude and float valves, both single-acting and double-acting types.

Lubrication—A monthly series of technical monographs on the lubrication of different types of equipment is now being published by the Standard Oil Company of Indiana, 910 South Michigan Ave., Chicago. It is planned to cover the whole line of the more important industrial equipment, making each lubrication discussion simple, brief and informative without recommending any particular brands of lubricants.

Bituminous Road Material—The Lincoln Oil Refining Co., Robinson, Ill., has published a booklet introducing Lincoln-lite, a bituminous powder used for road surfacing in connection with a road oil primer.

Truck Mixers and Agitators—A well-illustrated 40-p. booklet describing the 1932 Rex Moto-Mixers and agitators has been published by the Chain Belt Co., Milwaukee, Wis. It is designated as catalog No. 211. The catalog describes the equipment for the three general types of ready-mixed concrete plants: the dry plant, in which aggregates are batched at the plant and mixed in the truck en route to the job; the wet plant, in which concrete is made at the plant and is agitated en route to the job; and the shrink plant, in which the aggregates are shrunk with water, having a short mix at the plant and finally mixed on the way to the job.

Flexible Couplings—Catalog 11 published by the Diamond Chain & Mfg. Co., Indianapolis, Ind., describes the application and construction of the Diamond flexible coupling.

Tarvia Road Material—The Barrett Co., 40 Rector St., New York, has published a booklet on Tarvia and Tarvialithic which describes the uses and applications of these products.

Belt Conveyors—The handling and transportation of materials by rubber belt conveyors is described in an illustrated booklet issued by the Diamond Rubber Co., Inc., Akron, Ohio.

Special Motors—Bulletin 211 issued by the Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio, illustrates several special designs of electric motors indicative of the business of the company in manufacturing motors having special frames, shafts, windings or speeds or some other special feature applicable to unusual installations.

Palatable Drinking Water—Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, has published a booklet describing the preparation of palatable drinking water by the use of its product, Aqua Nuchar.

Portable Air Compressors—The Buhl Co., Old Colony Building, Chicago, has issued a booklet describing its line of portable air compressors and pneumatic tools and accessories.

Douglas Fir Plywood—Facts about Douglas fir plywood, describing the characteristics, application and uses of this product, are given in a booklet issued by the Douglas Fir Plywood Manufacturers, Skinner Building, Seattle, Wash. The bulletin also describes the method of manufacturing plywood and information concerning standard sizes and standard grades.

Bulldozers—Hydraulically operated bulldozers attached to tractors are described in bulletins 504 (models 51 and 54) and 510 (models 52 and 55) of the Baker Mfg. Co., Springfield, Ill. The blade of the Baker bulldozer can be raised 2 ft. above ground level or lowered to cut 12 in. below it, and can be set at an angle so as to throw the material to one side, instead of pushing it forward.